For People Interested in the Enrichment of Personal Computing

January, 1983 $3.50 in U.S.A.

99'er magazine

Covering the TI-99/4A
and other Texas Instruments
Personal Computer Systems

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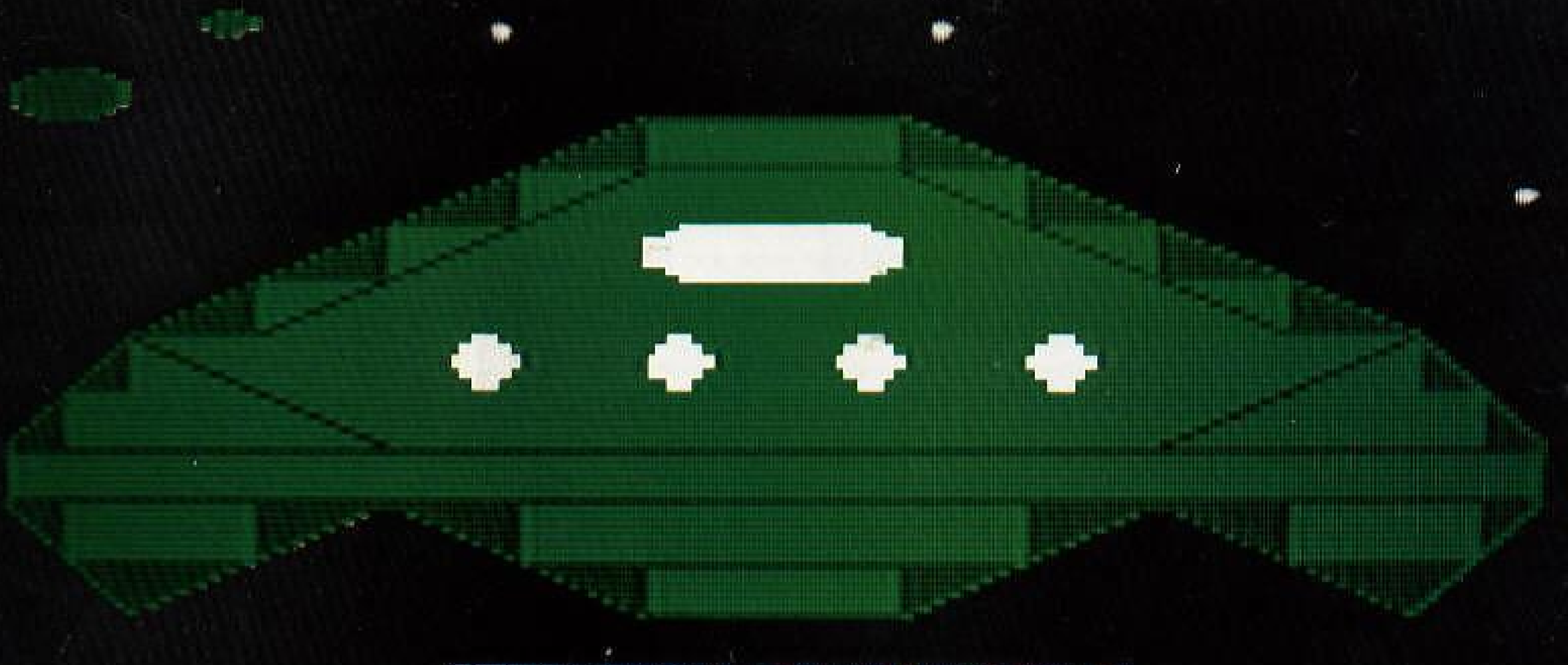

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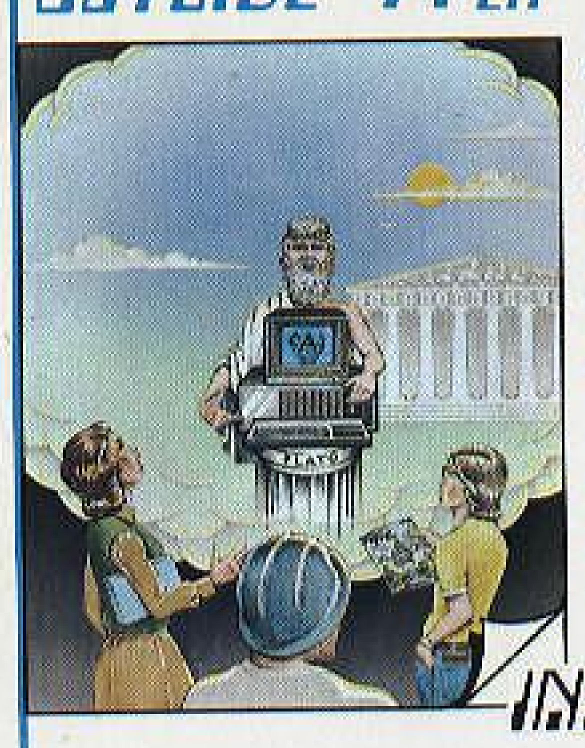
OUTSIDE 99'ER



This Issue's Cover

The inspired painting by staff artist, Laredo, bridges two millenia of education by bringing together the philospher Plato—symbol of ideal learning—and the Home Computer, offering the most advanced form of one-to-one learning. Regardless of their difference in Ages, they both are regarded as great teachers. This new implementation of PLATO software enhances the tradition of learning passed down from ancient Athens. This time, however, there's an important difference: the modern truth-seekers need not belong to a privileged society. With broad programs of Computer Assisted Instruction, it is now possible for citizens from all walks of life to have the opportunity of striving for and achieving their full potentials.

INSIDE 99'ER

HAPPY NEW YEAR! Was one of your resolutions to learn something new and wonderful this year? Computer Assisted Instruction (CAI) can be your path to this new knowledge. Soon you may never again feel the need to say, "That's all Greek to me!"

Speaking about being Greek, our feature article on PLATO (the CAI software version) will give you an overview of this history-making effort. See *A New Age of Learning: PLATO Computer Assisted Instruction* to find out all about the CAI programs soon to be offered *exclusively* to TI Home Computer owners—it'll be like having the best schools in the country right in your living room.

For our first foray into learning, see the uplifting review entitled *The 4A Into Flight: A Review of the Dow-4 Gazelle Flight Simulator*. You can actually learn the basics of flying a single-engine aircraft at night, and practice "touch and goes" without the fear of damaging your plane—not to mention, your life!

There are many handicapped people in the world—some who have been limited in communication to a simple yes and no. Teaching them even the most basic knowledge is difficult. One small step on this path to greater communication skills is presented in *Learning the Alphabet: CAI for the Handicapped*.

Music CAI is learning of a different note. The rudimentary knowledge of notes and pitch are the subjects of *99'er Musical Scorecard: A Review of Note Whiz and Pitch Master*.

You may put up some resistance when making the transition from music to electrical engineering, but that is, nevertheless, our next stop in the educational odyssey. *Training in Resistance: Electrical Engineering CAI* is not only a great way to learn how to work with resistor networks, but also illustrates BASIC structured programming techniques. Study of the program listing will help aspiring programmers to learn by example.

When going from TI BASIC to 9900 Assembler, we take a refreshing dip into a new language reservoir—i.e., *Super Language: Using the Line-by-Line Assembler*. In this tutorial series, you'll be shown how to use Assembly Language with the Mini-Memory package—a splendid adventure in learning.

The Joy of Adventuring—Part 1 is also a learning experience. Here, the history and structure of computer gaming adventures are explored.

When going adventuring, make sure you remember to save some luck and skill—you'll need them when trying your hand at *Cyber-Dice*. This Extended BASIC game using four computer-simulated dice, will certainly be a family hit.

Many times, games are a great way to bring the family close together. The theme from *Close Encounters of the Third Kind* and the idea behind the popular *Simon* party game have been masterfully combined into *Close Encounters of the Simon Kind*—an extraterrestrial TI BASIC game and pattern-recognition drill all rolled into one.

This month's *LOGO Times* article, *Debugging in LOGO*, is definitely no party game, but it will improve your programming efforts. And to set the record straight on TI LOGO, one of our contributing editors, Roger Kirchner, has written a *Letter on LOGO* to *BYTE Magazine*. We have reproduced it in this issue for your enlightenment.

And finally, there's this month's edition of *Portable Computing Magazine* with its feature article, *The p-System on the Home Computer—Part 2*. You'll learn to take command of three more of the System's basic functions, and will find out *Why Pascal?*

Until next month, have fun reading, learning, and RUNing!

99'er

PORTABLE MAGAZINE COMPUTING

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—By David G. Brader

48. Why Pascal?
—By David G. Brader

THE MAGAZINE OF LOGO TIMES THE LOGO LANGUAGE

42. Debugging in LOGO
—By Henry Gorman, Jr.

45. Letters on LOGO

Programming Conventions

KEY-IN REFERENCE

ABCDEFGHIJKLMNOPQRSTUVWXYZabcd
efghijklmnopqrstuvwxyz0123456789
!@#$%^&*()+=-/^{}_?""';<>,.:[]\

=Program as listed will completely fill available memory of TI-99/4A and cannot be RUN with disk controller (and possible RS232 interface) turned on. It must be SAVEd and RUN from cassette. It may also possibly be SAVEd and RUN from disk in Extended BASIC with the 32K memory peripheral if the last 2 character sets were not used.

99'er **=End of Program or Article**

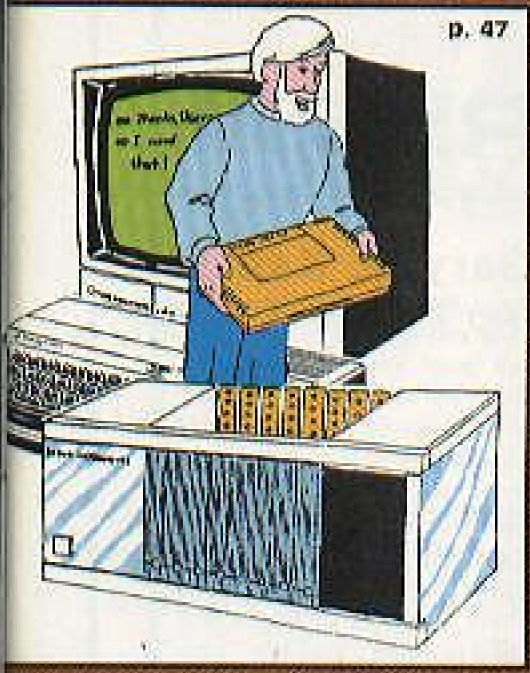
computer gaming

Speedup program pg 7 1st

99'er magazine™

January, 1983

Vol. 2, No. 3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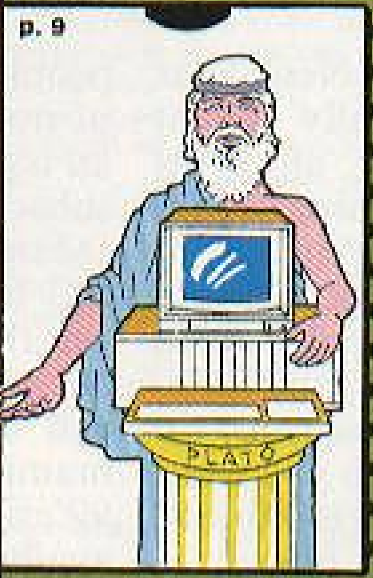
99'ER VERSION

2 . 3 . 1 . XB AL MM EM

volume no.
issue no.
version
1 = original program
2 … n = no. of update
TI Extended BASIC
Assembly Language
Mini-Memory Required
32K Expansion Memory Required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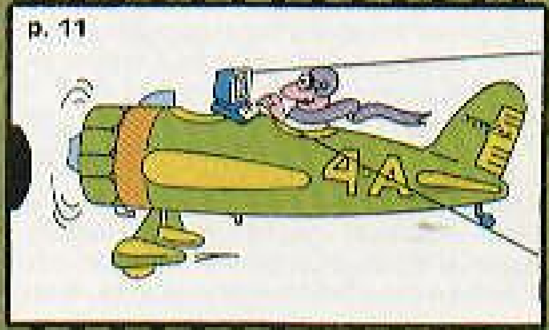
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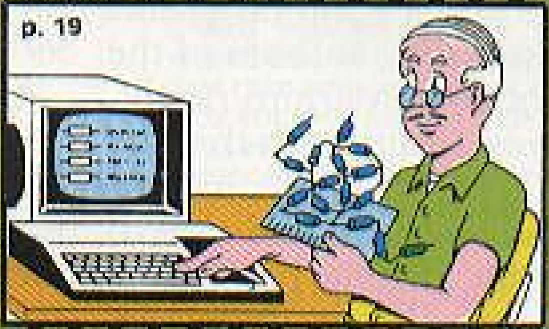
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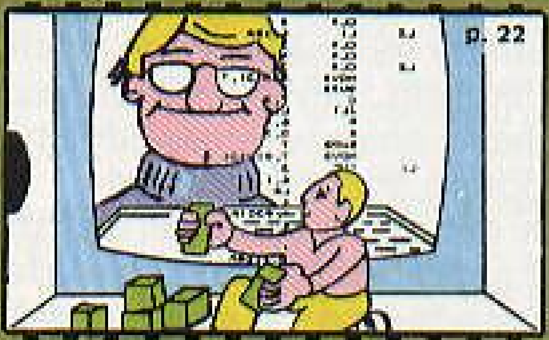
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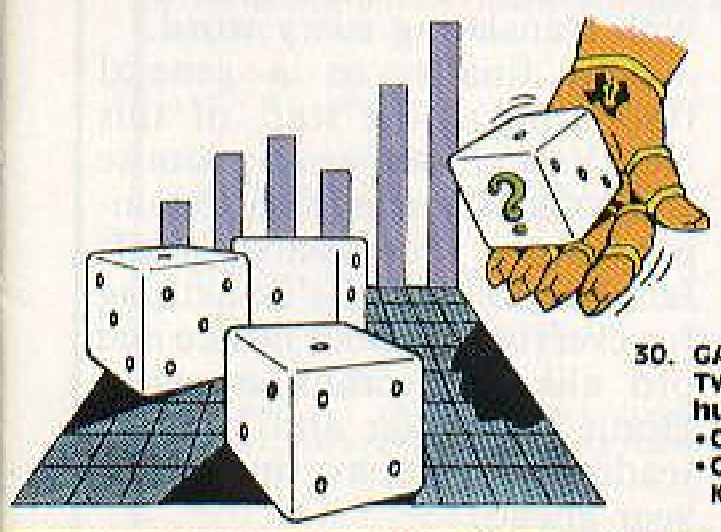

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99'er magazine™

A Resource for People Interested in the Enrichment of Personal Computing

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ON SCREEN

By Gary M. Kaplan
Publisher & Editor-in-Chief

The start of a New Year has traditionally meant resolutions of all types and kinds—everything from promises to break bad habits, to the publicizing of corporate projections and sales goals. So in keeping with the spirit and tradition of the Holiday Season, I'd like to now share with you some of *99'er Magazine's* resolutions for the exciting year ahead.

First off, starting with the February issue, there will be regular monthly reader surveys to rate the articles and programs in each issue. The authors of the articles and/or programs receiving the most votes in each issue will receive special award payments. This is in *addition* to their normal article remuneration and any Bonus Payments earned from inclusion in the supplementary *99'er Magazine-On-Tape* edition. Several 99'er authors have already received sizable Bonus Payments, and now with the additional merit awards, it appears that your submissions can indeed be quite a financially-rewarding experience—not to mention a career-boosting and personally satisfying one . . . So keep your material coming.

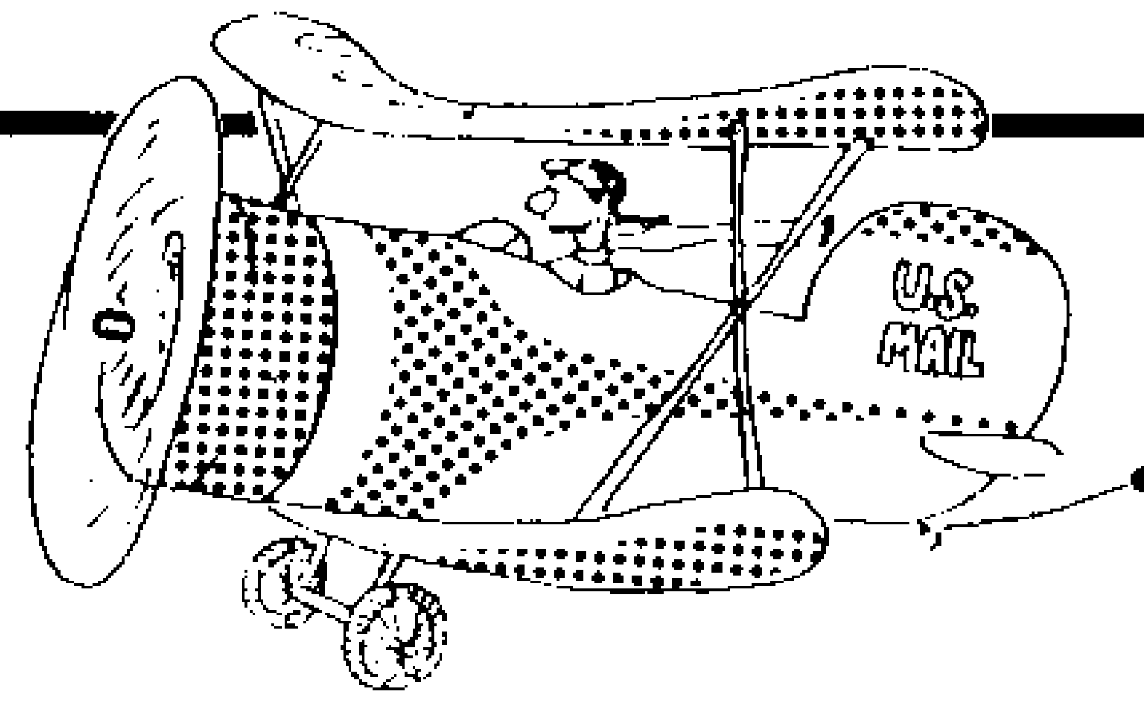
Don't be too surprised if before long you start seeing those familiar black and white "supermarket" bar codes on our cover. Now that we're monthly, our goal is to get *99'er Magazine* more widely distributed on newstands all over the U.S. and Canada. This will give the magazine much greater visibility and allow more people interested in the TI brand of home computing to pick up an issue or two *locally*—before subscribing.

For those new readers who feel bad about being unable to get the back issues that have been sold out, take note. By the end of this month, our new, mammoth book, *The Best of 99'er—Volume 1* should be available for purchase. It promises to be "the second most-valuable peripheral" for your Home Computer (the *first* being, of course, a subscription to *99'er Magazine* itself).

Shortly after the spring thaw, you'll start seeing the first units in the long-awaited 99'er Language Courseware Series. It *too* promises an easy way for Home Computer users to communicate with their new "intelligent machines"—thereby receiving the most benefit and enrichment from them.

Later in the year, foreign language editions of *99'er Magazine* will be readied for scheduled launching. This should provide welcome relief for those readers across the seas who presently have to struggle with translating every word.

And finally, as a general resolution at the start of this New Year, I once again promise you a varied menu of forthcoming features that, as always, offer the proverbial "something for everyone"—both novice and pro alike. So crank up your Home Computer and keep on reading . . . we have an exciting year ahead.



LETTERS TO THE EDITOR

Dear Sir:

I wonder how many readers know they can speed up their programs and have better control of sprites if they have Extended BASIC *and* Memory Expansion. At the location of -31878, the computer stores the number of sprites it should check. The default value is 28. That's right, even if you are not using any sprites, the computer still tries to update 28 sprites. If you load location -31878 with the value 0, the computer will not try to update any sprites and the program will run up to 48% faster! For example:

100 CALL LOAD(-31878,0)

When 0 is "poked" into that location, all sprite movement is stopped. If the value 2 is "poked" in, then only sprite numbers 1 and 2 will be able to move.

The following program will allow you to experiment with this. Values below 0 and above 28 can cause the system to crash.

```
100 CALL CLEAR
110 CALL INIT :: CALL LOAD(-31878
    ,0)
120 CALL CHAR(96,"000101")
130 FOR I=1 TO 28 :: CALL SPRITE(
    #I,96,1,96,128,RND*40-20,RND*
    40-20):: NEXT I
140 CALL LOAD(-31878,0):: FOR I=1
     TO 28 :: CALL LOCATE(#I,96,1
    28):: CALL COLOR(#I,16):: NEX
    T I
150 DISPLAY AT(3,1):"NUMBER OF SP
    RITES TO MOVE"
160 ACCEPT AT(3,27)VALIDATE(DIGIT
    )BEEP SIZE(-2):A
170 CALL LOAD(-31878,A):: GOTO 15
    0
```

The next program shows an effect that uses the same basic idea.

```
100 CALL CLEAR :: CALL SCREEN(2)
110 CALL INIT :: CALL LOAD(-31878
    ,0)
120 CALL CHAR(96,"000101")
130 FOR I=1 TO 28 :: CALL SPRITE(
    #I,96,1,96,128,RND*40-20,RND*
    40-20):: NEXT I
140 CALL LOAD(-31878,0)
150 FOR I=1 TO 28 :: CALL LOCATE(
    #I,96,128):: CALL COLOR(#I,16
    ):: NEXT I
160 CALL LOAD(-31878,28)
170 FOR I=1 TO 170 :: NEXT I
180 CALL LOAD(-31878,0)
190 CALL DELSPRITE(ALL)
200 GOTO 110
```

The last program shows another interesting effect that is based on the idea.

```
100 CALL CLEAR :: CALL SCREEN(2)
110 CALL INIT :: CALL LOAD(-31878
    ,0)
120 CALL CHAR(96,"000101")
130 FOR I=1 TO 28 :: CALL SPRITE(
    #I,96,1,96,128,RND*40-20,RND*
    40-20):: NEXT I
140 CALL LOAD(-31878,0):: FOR I=1
     TO 28 :: CALL LOCATE(#I,96,1
    28):: CALL COLOR(#I,16):: NEX
    T I
150 CALL LOAD(-31878,28)
160 FOR I=1 TO 28 :: CALL LOCATE(
    #I,96,128):: NEXT I :: GOTO 1
    60
```

Good luck, and have fun.

Jon Burt
Santa Ana, CA

Thanks, Jon, your sample programs are fun! Sharing your discoveries and ideas can only stimulate more of the same. Any neat tricks that you have found in TI BASIC would be most welcome to 99'er Magazine readers. By the way, in the latest version of Extended BASIC, the sprites are not activated or checked for unless you specifically "CALL SPRITE."

Dear Sir:

I wanted you to know how much I appreciate the work you're doing in your magazine. Before I found out about the 99'er I despaired of ever learning how to program the TI-99/4A. Your magazine has shed a great amount of light on the problems that are encountered in working with the TI and as a novice programmer it really has meant the difference, to me, in learning to program the TI-99/4A. So once again thanks!

Marshall Gordon
Woodstock, GA

We aim to please, Marshall! Learning to program means learning to communicate with man's greatest tool—the computer. Increasing communication in general, also increases knowledge.

Entering 99'er Programs

New readers should be aware that within the magazine's pages are found actual computer programs that *you* can put into your Home Computer and enjoy.

Make sure you have any special system components required by the program (i.e., the Speech Synthesizer, Extended BASIC cartridge, etc.). Then, using the console keyboard, you can type the printed magazine listing (character for character, and line by line) into the computer's memory.

Before entering the program, connect a cassette recorder to the computer. Make sure you have two blank cassette tapes. For each 10-20 lines you type in, use SAVE CS1 to save that program segment onto one of the tapes. Alternate between the two tapes each time you save the program. Be sure to rewind to the beginning of each tape before saving, so that you always record over and replace the shorter segment of program lines with the longer segment. By following this procedure, you'll always retain most of your work even if the lights go out or someone turns off the computer.

Double check your typing against the program listing for errors, and *then* have someone else check it. The most common errors are typing the letter "O" instead of the number "0" (zero)—they are *not* interchangeable to the computer. This is also true for the letters "I" and "L" and number "1" (one). [See "Key-In Reference" on p. 4]

Every time you make a correction to your program, SAVE CS1 and switch the tapes. Once all the errors are corrected, you will have a good copy of the program on the last tape. Before turning off the computer, put the other cassette tape in your recorder and once again SAVE CS1. Now, if one tape gets damaged, you won't have to enter the program listing via the keyboard all over again. Have fun and happy computing.

Dear Sir:

Your magazine is outstanding for many reasons. Charles Ehninger's game, Enemy Attack, is a lot of fun for everybody. It starts so easy that you can hardly lose and finishes so hard that you can hardly win; there is something for everybody. But after you have been through the course a few times, you would just as soon get on to the real action in the third level; the first two become boring. I added a step:

2295 INPUT "PRESS 3 FOR EASY, 1 FOR HARD":GM

This lets the aces get right with it at the top level.

Armbruster's column on recorders was very helpful. I set out to buy the J.C. Penny model which he found to be the best, and I was advised that it was no longer being offered. I tried their later model 681-6568, catalog #851-1396, at $40 list, and it hasn't missed yet. It has a metallic finish which matches the TI-99/4A. I set the tone on high and the volume in the middle.

I had an old Sears Model 799.21655700 which was a $70 value marked down to $40 a few years ago. It is worthless for this purpose.

I also had a GE Model #3-5001A which cost $20. It requires your TEX-SETTE adapter (the others do not). The GE recorder worked most of the time, but it is surely worth the extra twenty dollars to get the dependability of the Penny model.

Robert B. Stephenson
Albuquerque, NM

Thanks for the tip on Enemy Attack, Robert. All you hot-shot gamers take note! To add a note of my own to your cassette recorder comments, it seems the expensive units, in general, work the worst. I have been using a G.E. Model#3-5105G for many months without any problems.

Dear Sir:

Here is a new way of using the REDO command. If you want to REDO a line that was *not* the last line entered, here is what you do: First you enter the line number then press the down arrow. Next press the ENTER key. If you now press REDO this line will be retyped allowing you to move it by changing the line number. I found this trick to be very useful. I discovered this by accident.

Jim Currey
Chicago, IL

Jim, this is a neat trick if you are using Extended BASIC on the TI-99/4A.

Dear Sir:

I'd *also* like to add my note of compliment to the many you have already received—you are doing a super job—those of us that are new to computers will always be grateful for the help your magazine has given us. I do hope that as the magazine matures you will not forget that there are always beginners among your readers—please don't ever forget them!

Looking forward to your next issue. Each of my present magazines are rather dog-earred from months of paging!)

Alan Fox
Regina, Sask, CANADA

We fully realize that you and other "beginners" depend on 99'er. We shall not forget!

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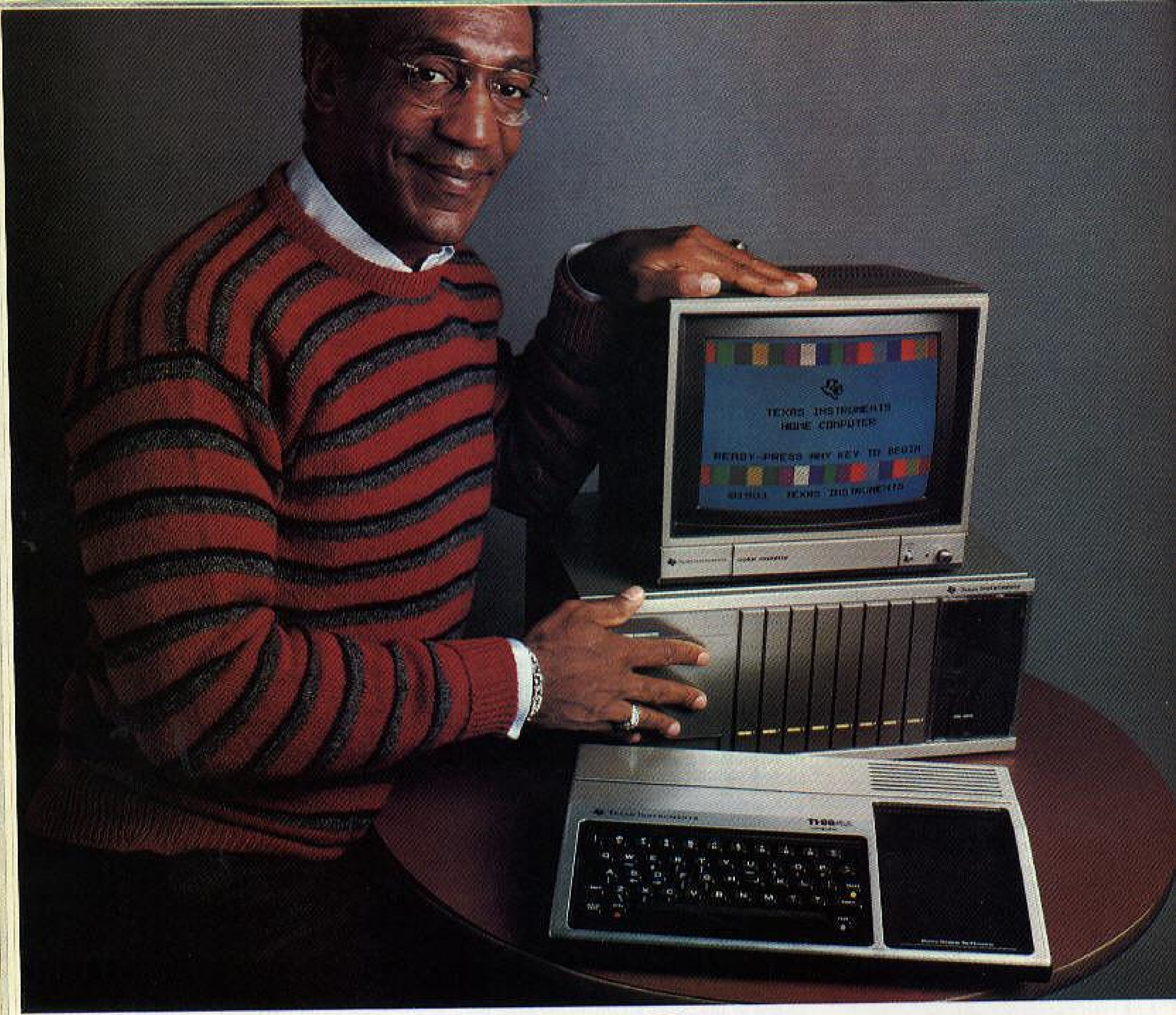

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Sound impressive? Compare a TI Home Computer with the competition and really be impressed. You won't even need a computer to tell you this is the one.

TEXAS INSTRUMENTS

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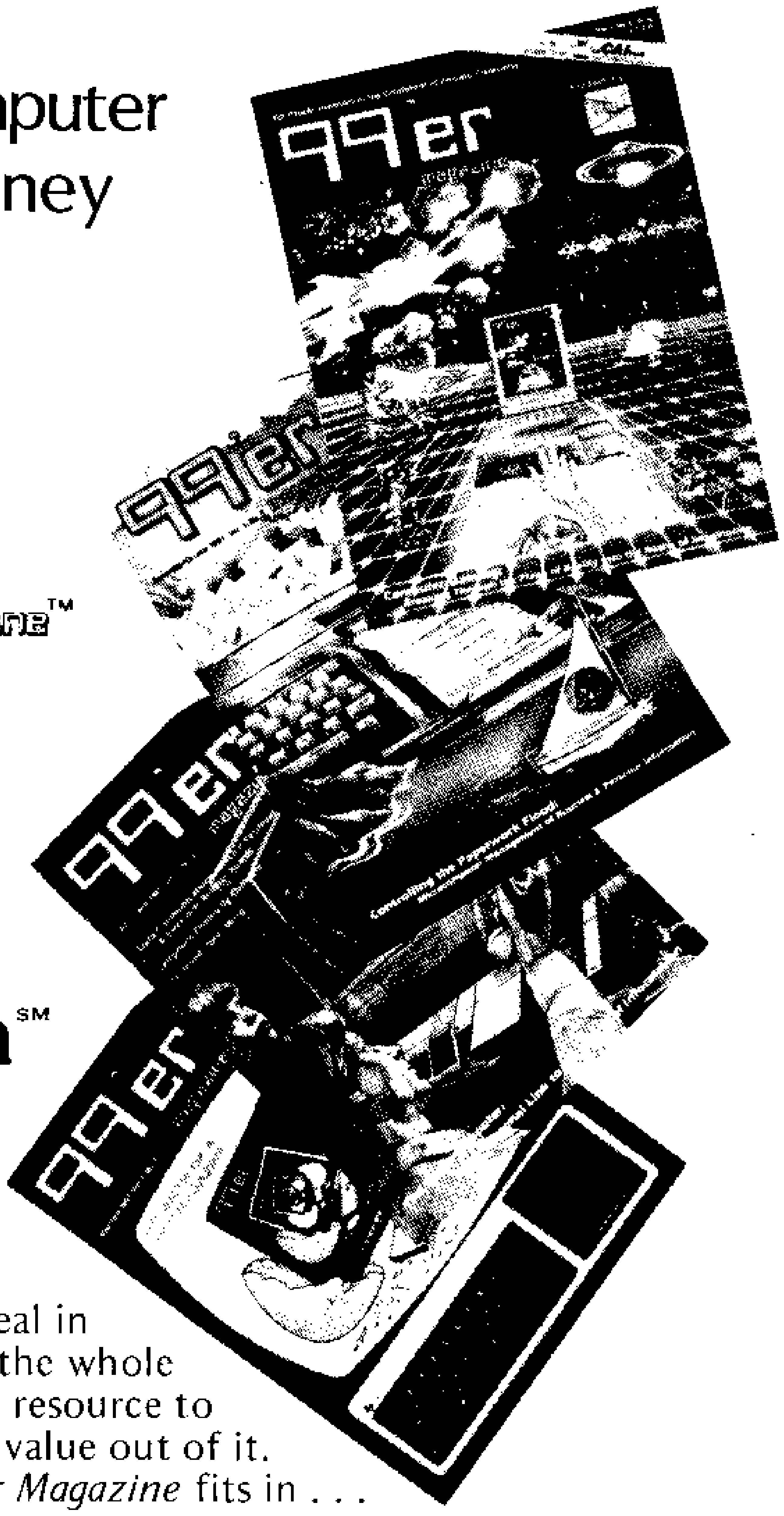

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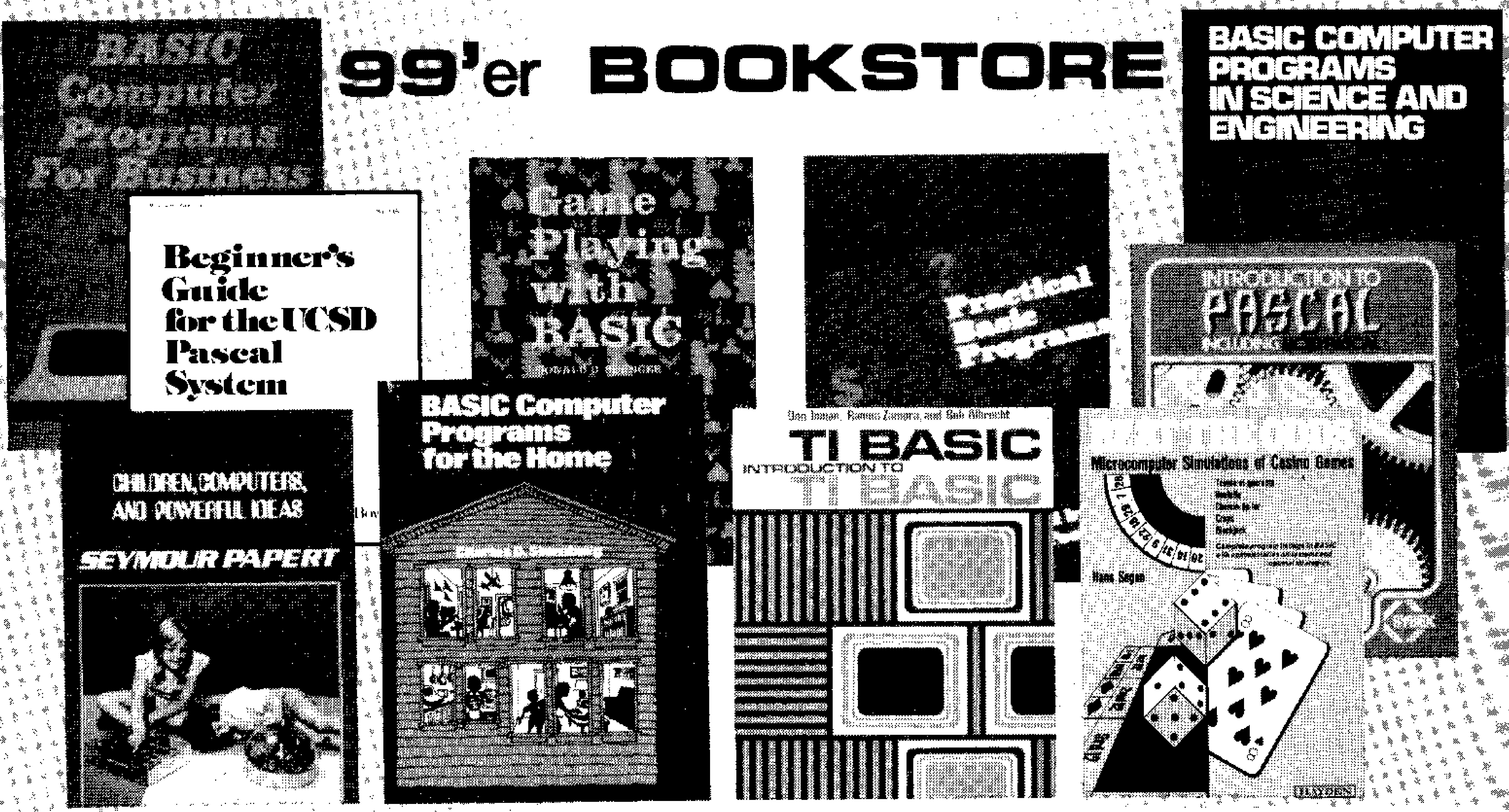
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A NEW AGE of LEARNING: PLATO

Computer Assisted Instruction

By Greg Roberts *99'er Magazine Staff*

The computer as teacher: What mark will it make on our civilization? How will it compare with other milestones in history? The computer teacher may not rank with the discovery of fire, nor the invention of the wheel, but certainly it will prove more significant than such devices as the telephone and the automobile—even the printing press. The comparison with the press seems most fitting, in that both inventions go beyond mere machinery and mechanical ease—to a promise of bone-deep social change. And in that wider sense, Computer Assisted Instruction (CAI) perhaps may be likened to an historical document, say the Magna Carta or the Declaration of Independence: the computer teacher as the great equalizer. Yet CAI—unlike some well-meant decrees that take centuries to fulfill their promises—is working now, within two decades of its inception.

Any current discussion of computers in education has to start with the PLATO library and its chief promoter, William C. Norris—just as an early discussion of aviation would probably center on a certain flight in 1903 and a team of brothers named Wright at Kitty Hawk.

The name PLATO is meant to remind us of that ideal educational setting in ancient Athens, where the most illustrious student of Socrates set down some of the foundations of modern civilization. PLATO is a fitting name for this idealistic education plan based on a computer library of some 12,000 course hours—from Archaeology to Xylography—a library made accessible in the most enlightened ways known.

Over the past 20 years the parent company of PLATO, Control Data of Minneapolis, simply guarded the treasure, dipping into it only for training programs requested by big business, universities, and the government; in other words, it was limited to those who could buy the output of large, expensive computers.

That this limited, privileged situation is quickly changing is no longer a secret. The news blockbuster was Control Data's announcement to make the PLATO library available for several brands of small computers—a bright signal that a floodgate was opening.

For now, the first mere drop from that reservoir is made up of nine lessons—three of them in arithmetic, four in foreign languages, a basic lesson in physical mechanics, and an introduction to computer literacy.

TI Teams up with Control Data

The PLATO programs will be issued for computers by TI, Atari, and Apple, but only TI users will get in on some extraordinary benefits: Control Data has announced a separate agreement with Texas Instruments, in which the makers of the TI-99/4A hold exclusive rights to more than 500 PLATO programs, organized into 108 software packages. Described by a TI spokesman as "the pick of the litter," TI's choices are programs expected to be of most interest to homes and schools—a body of work more comprehensive than any other set of CAI for a microcomputer.

Besides access to these initial 800 hours of programming, TI owners are entitled to benefits in technology. PLATO programs for the TI-99/4A are used with a Command Cartridge, making the information much easier and faster to use than with other computers. Also, TI's versions of the PLATO programs are superior in graphics—the only ones with sprites. In addition, TI has enjoyed great success in condensing the information so that four to six programs will fit on a diskette. They will be as convenient as phonograph records.

But the biggest news yet is that Control Data and TI are now making plans for third-party programmers to contribute their own CAI to the TI-PLATO library—to enlarge or modify existing PLATO programs to create truly personal lessons. Interested programmers may rent a Control Data terminal to interface with a TI-99/4A system—an arrangement that will likely lead to a groundswell of specialized software as diverse as knowledge itself.

Proving Grounds for PLATO

True, programs costing from $20 - $40 will not be affordable to great masses of consumers; but it is likely that public libraries will start buying PLATO programs, user groups will form networks, and eventually the technology may drive the prices down.

The initial reforms probably will take place in our schools. Right now many schools can afford microcomputers, and many are already providing CAI for their students. As more and more try PLATO, they will keep adding to the mountain of evidence that this system works.

For example, Berendo Junior High School in Los Angeles was a run-down, unproductive ghetto school with little claim to fame other than the size and duration of its gang wars. Several years ago it leased twelve PLATO computer terminals from Control Data. The machines were mostly used by "problem students"—the class cutters, the troublemakers, the ones who hated school. Their requirement for getting into the computer learning program: an ability to read at the third grade level.

Continued on p. 16

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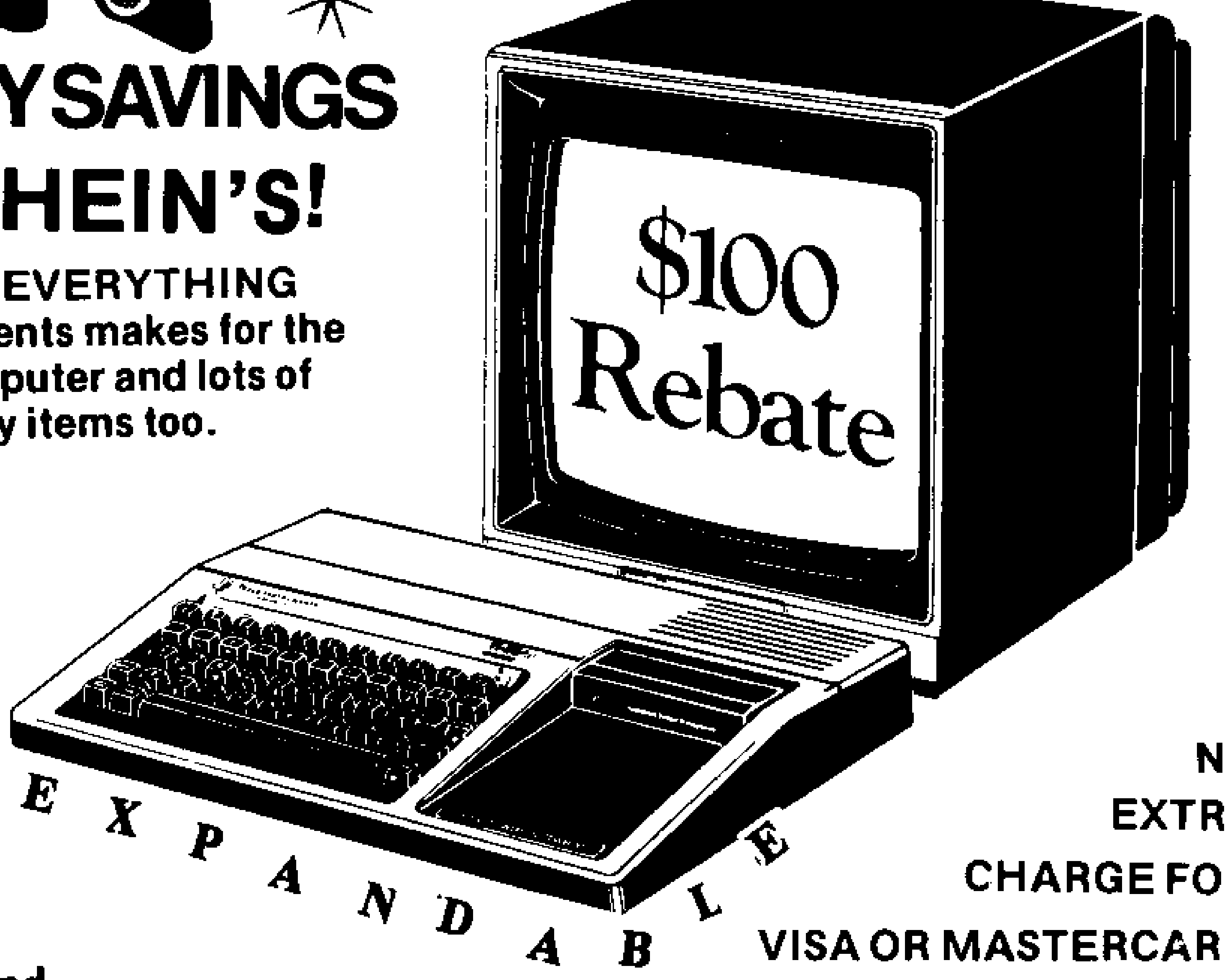

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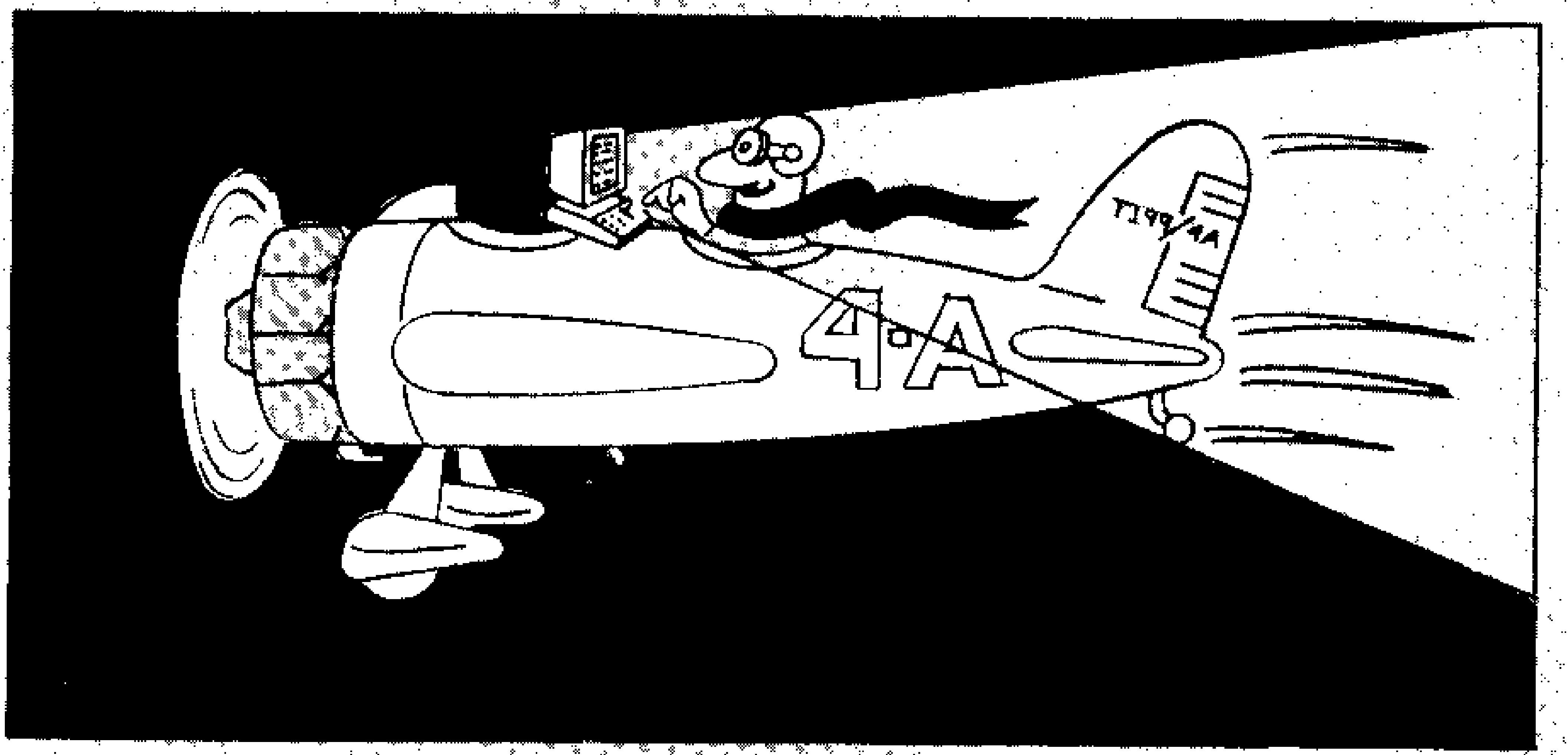

A Review of the Dow-4 Gazelle Flight Simulator

By David Welcker

261 South St.
West Bridgewater, MA 02379

Learn to Fly! That is the challenge of *Gazelle* by John T. Dow. From the first roar of the Gazelle's engine, this real-time simulation will keep you on the edge of your cockpit seat. And it does so without a single laser blast or invading alien! What grabs your attention is your sudden take-off as the pilot of a single-engine plane—and the scenario is likely to include a frenzied operator, a dog-eared manual, and joysticks wet with perspiration.

Before taking control, you have to absorb thirty pages of text and several drawings, and you can expect to consult the manual for at least the first few flights. During flight, the screen displays a dashboard—ten dials and eleven indicator lights which the student pilot must understand and manipulate via the joystick and keyboard controls. Above the dash is an indicator in the night sky showing the distance and direction to the landing field. As this is the only non-instrument indicator, the simulation is even more difficult than daytime flying—you can't even look out the window to see how the plane is situated.

When you finally land the plane (under these circumstances it took me about fifteen tries) there is the further challenge of instrument landings with more sensitive controls, short-field landings, and rapid take-offs—as well as "challenges for the advanced pilot," suggested in the manual. After mastering them, the pilot can choose to tackle maneuvers under varying turbulence. As a result, the program keeps its appeal, even when mastered. And unlike some challenges for 99'ers, the "expert" sessions need not become marathon.

Speed of response to your controls is excellent and realistic. A "time out" option lets you freeze the action in order to deal with backseat drivers, calls of nature, and disgruntled spouses. If you make a mistake (by flying too fast, missing the runway, or losing control), you'll hear the crash followed by the whine of the ambulance. The cause of your misfortune is displayed with other flight data, including start options. Safe landings earn a musical pat on the back and the warm satisfying glow that comes only with mastery of this demanding task.

Some will complain that *Gazelle's* instruments are hard to read, in that pixels (dots) make up the indicator needles and calibrations. I have not found this hard to get used to, but if you have eyeglasses, be sure to wear them. In any case, the increased speed is worth the squinting. The program makes use of the full 16K, thus some of the usual title screen/text amenities are left out (and barely missed).

And best of all, you really can learn the principles of flying! The interaction of the controls and indicators is quite well integrated. The game is so realistic, that the level of understanding needed to play it probably excludes anyone too young to fly a real plane in the first place!

Whether to teach or to entertain, this simulation will meet all your expectations. And should you accept the challenge of *Gazelle*, please watch for me up there—my registration is Tango India Niner Niner Four Alpha.

Dow-4 Gazelle by John T. Dow is available in TI BASIC (joysticks required) for $30.00 on cassette through John T. Dow, 6360 Caton, Pittsburgh, PA 15217.

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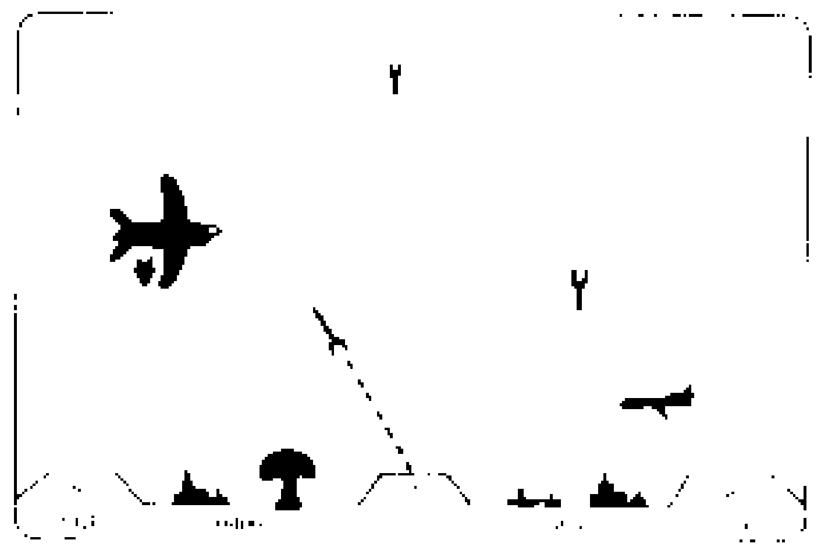

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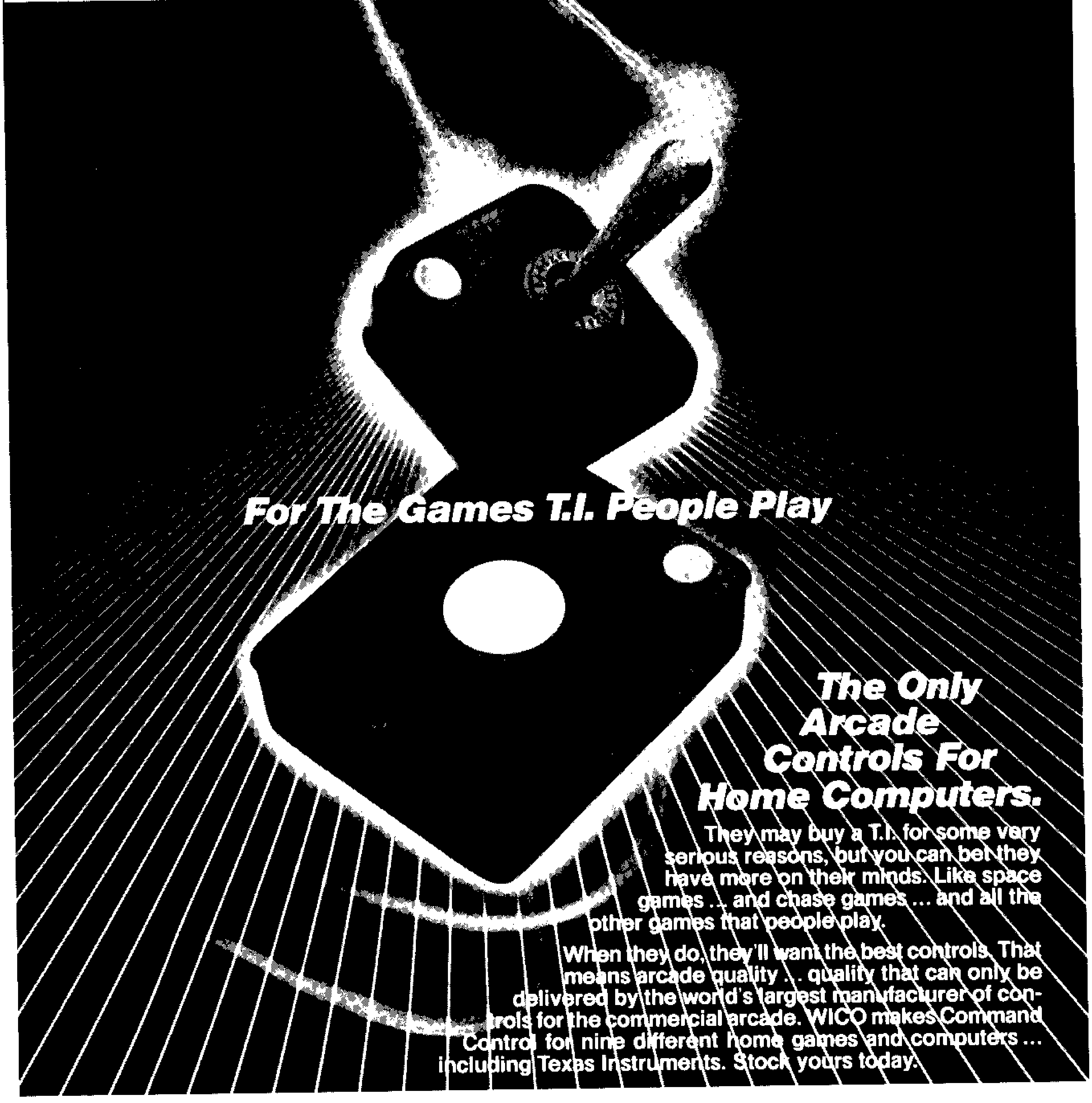
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* Available in Fourth Quarter 1982
† Developed by Scott, Foresman.
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PHT 6007	Teach Yourself BASIC	29.95	24.00
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PHT 6018	Market Simulation	14.95	12.00
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PHT 6026	Bridge Bidding I	24.95	20.00
PHT 6031	Speak & Math™ Program (Solid State Speech™ Synthesizer and Terminal Emulator II are required)	24.95	20.00
PHT 6039	Bridge Bidding II	24.95	20.00
PHT 6041	Bridge Bidding III	24.95	20.00
PHT 6042	Spell Writer (Terminal Emulator II Command Module and Solid State Speech™ Synthesizer are required)	24.95	20.00
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PHM 3023	Hunt the Wumpus	24.95	20.00
PHM 3024	Indoor Soccer	29.95	24.00
PHM 3025	Mind Challengers	24.95	20.00
PHM 3030	A-Maze-Ing	24.95	20.00
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PHM 3053	TI Invaders	39.95	32.00
PHM 3054	Car Wars	39.95	32.00
PHM 3057	Munch Man	39.95	32.00
PHM 3042D	Tunnels of Doom (2 Diskette Games Included)	59.95	45.00
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PHD 5016	Structural Engineering Library	29.95	24.00
PHD 5044	AC Circuit Analysis	29.95	24.00
PHD 5063	UCSD-PASCAL(2) Compiler (32K Memory Expansion and P-Code required)	124.95	100.00
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PHD 5068	Course Designer Authoring Package (Extended BASIC required and Video Controller optional)	199.95	150.00
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PHL 7009	The TI Arcade Game Series	119.85	90.00
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(1) Available only until replaced by peripheral card
(2) UCSD, UCSD Pascal and UCSD p-System are all trademarks of the Regents of the University of California
(3) Othello is a trademark of Gabriel Industries
(4) Course is designed to be used with Circuit Analysis I textbook

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PLATO . . . from p.9

PLATO was instantly attractive to the students. For one thing, it was private. Students who were seriously behind in their work escaped the embarassment of looking ignorant in class. They could relax before the screens and progress at their own rates, trying the same problems over and over again when necessary.

The computer rewarded them with replies such as, "That's right," "Terrific—try the next one," or "Better, re-read chapter three." The students' test scores started to improve dramatically.

For education, the implications carry great hope. Imagine a teacher not wasting hours each day on beginning reading and multiplication drills. Think of a classroom with intelligent *discussions* going on instead of the same mind-dulling drills. Perhaps then, teachers might have time for extracurricular activities such as clubs and student-founded learning groups. It is even possible that students might then develop interests that could change their lives—through an artistic group or science project. Right now these things suffer in our schools—not so much from money problems, nor from a lack of teacher interest, but because the teachers don't have time.

Of course, not all teachers have quickly embraced computer education. Fearing the loss of their jobs to machines, some teachers have grown suspicious and reactionary without ever having seen a computer in the classroom. And yet, when teachers take a close look at computer-assisted education, they often realize that it is a minimal threat—if a threat at all. Regardless of the machine's knowledge, it is still most useful in the presence of a *human* teacher—supervising, explaining, and expanding the lessons.

Other In-Roads

Schools are not the only proving grounds for Control Data's PLATO campaign. It has been used in a wide variety of applications that point to far-reaching social change. For example, the Department of Labor is funding PLATO programs in 50 of its Fair Break centers for the chronically unemployed.

Thousands of businesses, large and small, are finding it worthwhile to train or retrain their personnel through PLATO—usually at Control Data Learning Centers, now numbering more than 100.

Even state governments have been drawn to these new concepts. Pennsylvania's Governor Thornburgh has announced that his state is putting up more than a half-million dollars to start PLATO learning for unemployed steel workers—a pilot program likely to expand.

Cottage-industry computer work is giving new hope to disabled persons in a PLATO training program called Homework, and inmates in various state prisons are educating themselves so that they might find jobs after their release.

The Man Behind PLATO

If there is any one person who can take credit for PLATO, it is William C. Norris. No one has higher hopes for this program than he, the founder of Control Data—the only corporation which showed interest in the idea when it was offered to American business by the University of Illinois in 1962.

Norris' enthusiasm is apparent from the amount his firm has invested in PLATO: $900 million. But much more telling are the remarks he made to the business magazine, *Corporate Report Minnesota*: " . . . today, through the availability of PLATO, the one-room country school in Nebraska, where I went to school, could have a curriculum exceeding that of Minneapolis schools."

He goes on, "We ought to have much smaller units in the cities, on a neighborhood basis where kids can get to know each other. Today you go to one of these big anthills, and if you survive, you're damn lucky, and if you learn anything you're even luckier."

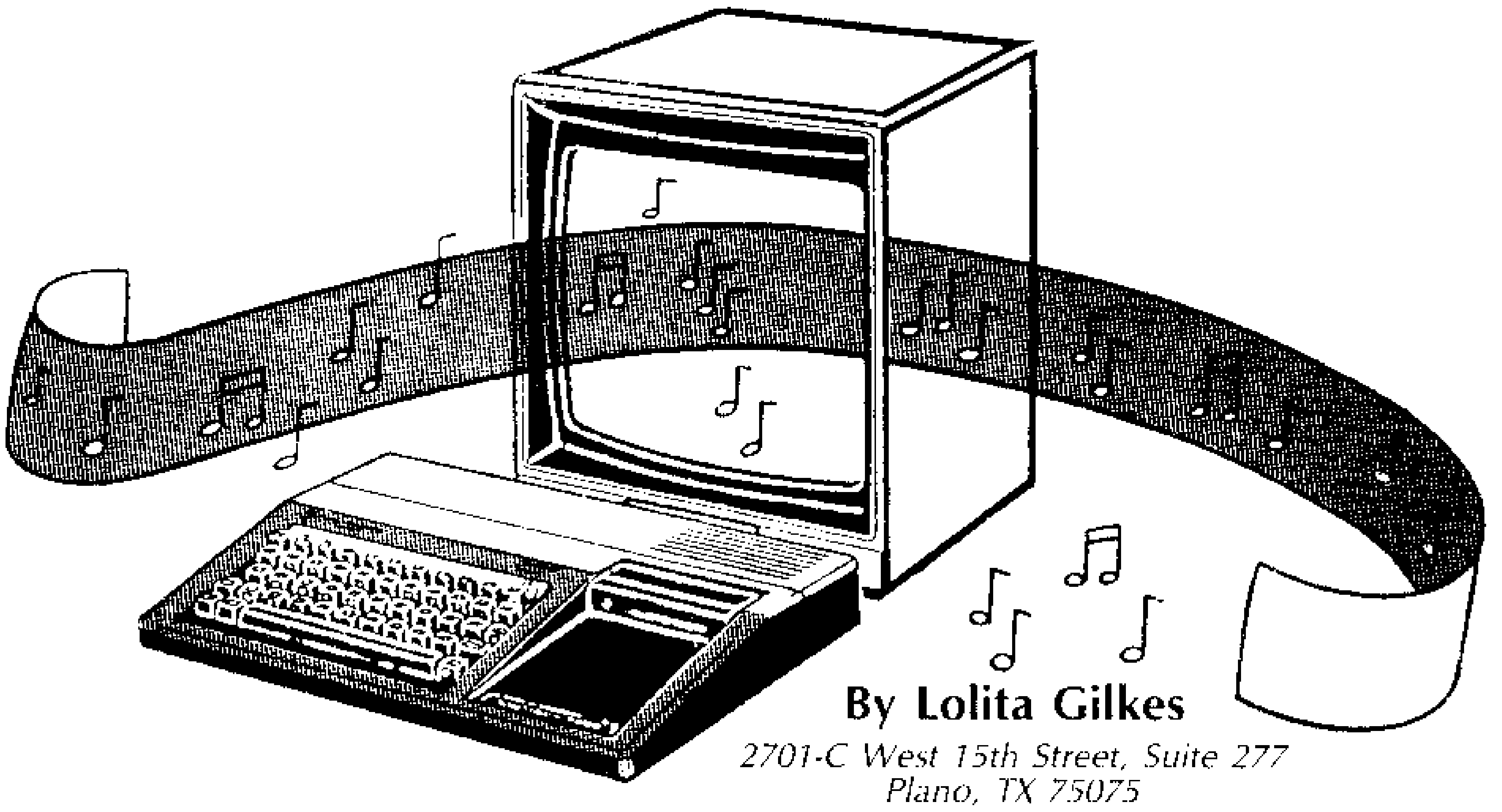
"I think it's terrible that we've drifted into this situation. But God yes, the computer can reverse all that."

Norris was confident in a statement to the *New York Times*. "Computer-based education is going to shut off this stream

Continued on p. 57

99'er Musical Scoreboard:

A REVIEW OF NOTE WHIZ AND PITCH MASTER



By Lolita Gilkes
2701-C West 15th Street, Suite 277
Plano, TX 75075

In the field of music education the potential for computer-assisted instruction (CAI) is great, but the quantity of software is limited. For this reason it is very exciting to see the arrival of two pieces of quality software from Meca, Inc. The programs *Note Whiz* and *Pitch Master*, created by a university music professor, offer both entertainment and sound educational merit.

The *Note Whiz* program is probably of greater general interest and utility since *Pitch Master* deals with more sophisticated musical concepts—but both programs are welcome additions to the existing body of music software.

Note Whiz is designed to sharpen a student's skill at rapid note reading on any or all clefs—treble, bass, alto, or tenor. After selecting the clef, the player may opt to review the notes on that clef via a display identifying the musical lines and spaces.

Armed with that knowledge, he is ready to venture on a race against the clock, testing for speed and accuracy in the naming of notes. He then selects the level of play. Level one, for beginners, uses only the notes on the staff. Level two may use up to two ledger lines above and below, as well as the notes on the staff. Level three, the *Monster Whiz* may use up to four ledger lines above and below. The challenge of level three is guaranteed to produce an audible sigh in any player, but once the initial panic is over, he will love it!

The notes for each level are randomly generated as the computer does a "count" while the player goes through the quiz. A mistake will freeze the screen, so that it does not proceed until the mistake is corrected. After naming the tenth note, the player gets a musical "reward" message. The better the score, the more elaborate the music, making one want to keep trying for more.

After each game, several options are available: One can change to a new level or clef, change players, or stop. The data from each game can be recorded on the TI Thermal Printer: the date, each player's name, the clef(s) used and the level(s) of play, as well as the scores. This provides an excellent means of tracking a student's progress.

Note Whiz is a simply designed drill and practice game program, yet it has wide appeal and effectiveness. I used it very successfully with a first grader who loved the beginner level, and with high school students who were challenged by the *Monster Whiz*. They were intrigued by the alto and tenor clefs—rarely seen by most students—clefs used primarily for viola, bassoon, and tenor trombone.

The *Pitch Master* program is designed to strengthen the player's "ear" and his memorization of a note sequence. This menu-driven program offers a series of melodic dictations whose limits are set in advance. The options are 1) treble clef—major key, 2) treble clef—minor key, and 3) bass clef—major key. Next, the musical key for the dictation can be chosen from the nine diatonic keys offered. The range of the notes must be selected, (up to 1½ octaves), and the number of notes (from 1-10) to be included in each example. The computer then prints the selected scale and plays it in order to orient the player to the proper tonality—then a five-question quiz.

Each musical example is preceded by sounding the tonic tone (scale degree 1) to help the listener maintain his feeling for the key. The player then listens to the example and enters, by scale degree, the pitches he hears. For example, if he hears the pitches G-F-E-D-C in the key of C, he enters 5-4-3-2-1.

Conceptually this program is similar to the "Phrase Recall" section of the *Musical Skills Trainer*, but I find it superior in several respects. Like *Note Whiz* this one is interspersed with musical rewards. The author has also taken advantage of the graphics and color capabilities of the TI computer to make it visually stimulating. As with the "Phrase Recall" program, the student is able to change his answers. However, *Pitch Master* allows unlimited rehearings of the musical example—although they do not repeat the tonic tone. This rehearing option is an invaluable feature, because most users probably will not be skilled listeners. (Incidentally, the *Pitch Master* deducts one point from the final score for each rehearing.)

Another advantage of this program is that, by using scale degrees to respond to the dictations, it was not necessary to redefine the typewriter keyboard. Understandably, young users can be confused to sit at the computer console (an arrangement already somewhat foreign to them), and find in a reference book that the Z key will now represent a C, X will be a D, and so on.

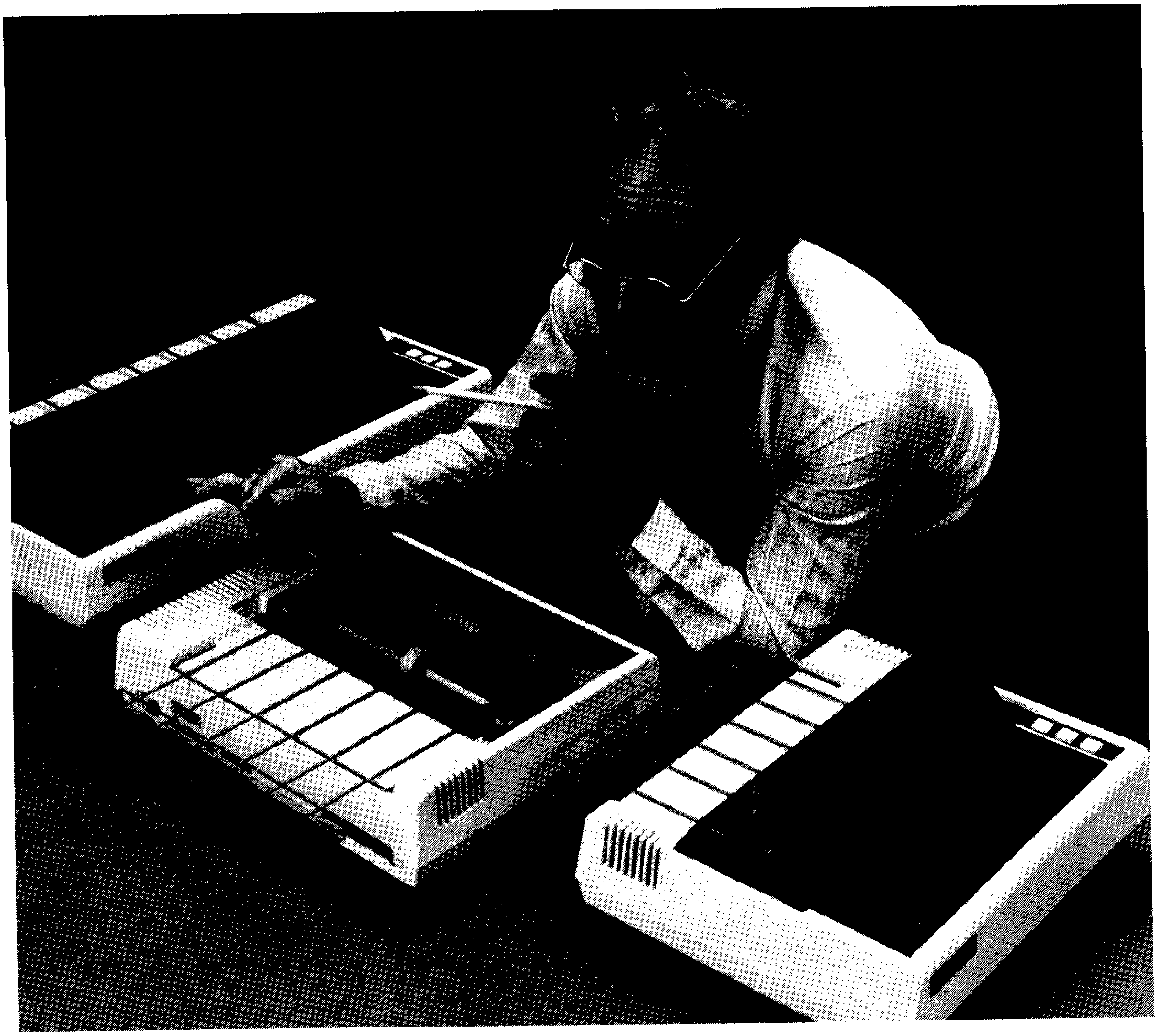
A little-noticed virtue, perhaps, of computer-generated programs is that they give students the opportunity to expand their aural memory and vocabulary in terms of the twentieth-century musical language. These programs offer note progressions outside the eighteenth and nineteenth-century musical tradition, and therefore tie in to a student's understanding of music history as well as music theory.

The development of refined listening skills is fundamental to the development of fine musicianship. After all, we play instruments not so much with our *hands*, as with our *ears*. The *Pitch Master* program can be an extremely effective tool in meeting this objective. My one criticism of these programs is that *Note Whiz* and *Pitch Master* have been tied in solely to the TI Thermal Printer, excluding many users from the useful record-keeping feature. I would hope that Meca, Inc. will modify its software to make it compatible with other printers. Nevertheless, I recommend these programs for music-related fun and learning—in the classroom, the music studio, and the home.

Note Whiz and *Pitch Master* are available on diskette or cassette (requires Extended BASIC) for $29.95 from: Meca, Inc., P.O. Box 5425, Richmond, VA 28220.

ABOUT THE AUTHOR

Lolita Gilkes has done graduate work at the University of Texas at Dallas, where she is presently writing her thesis on the piano music of Igor Stravinsky. Mrs. Gilkes is also compiling a directory of all music-related software for use on the TI-99/4A computer.



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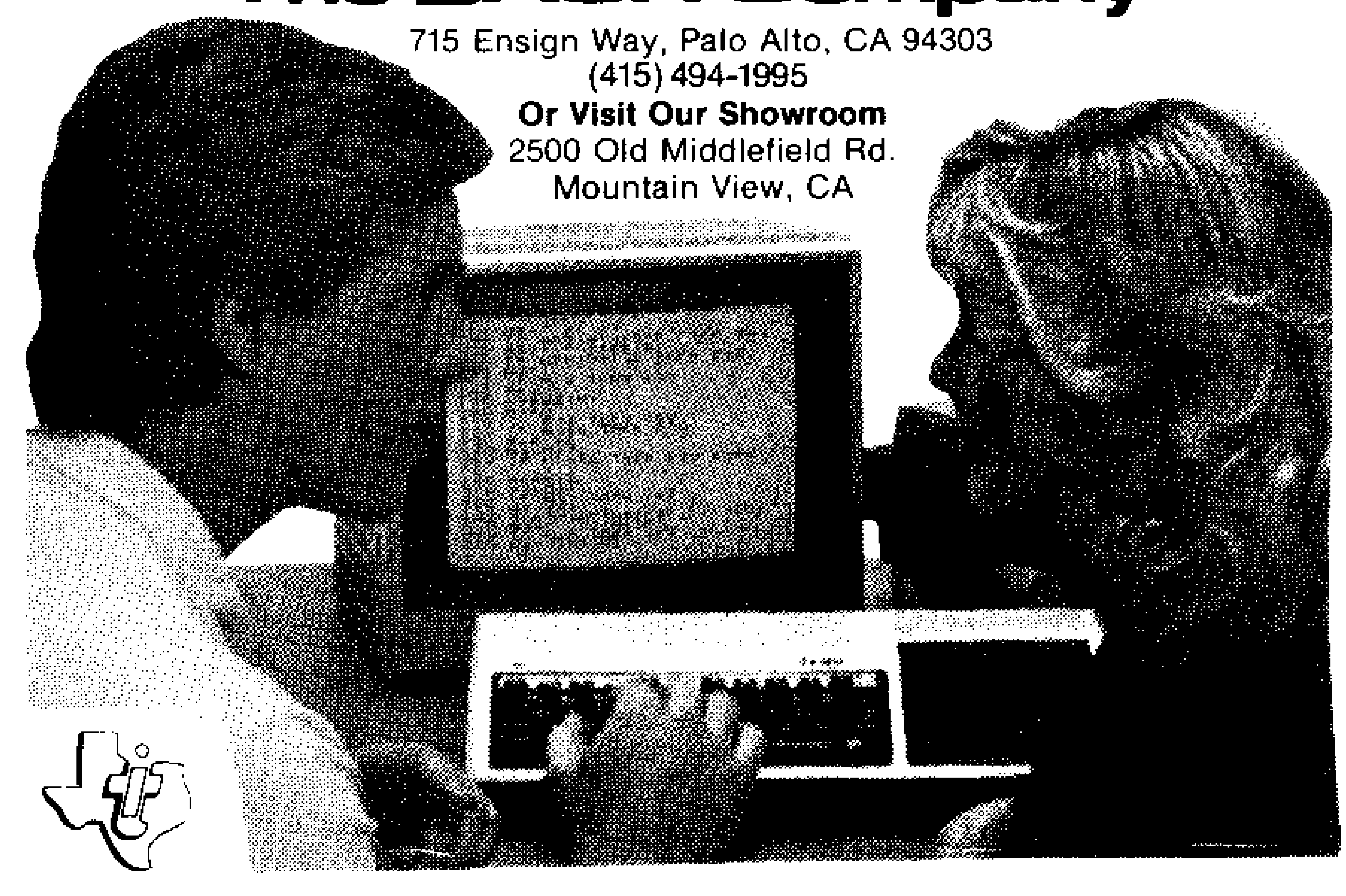

Letters . . . from p. 7

Dear Sir:

I have owned a TI-99/4 for 2 years now and have enjoyed using it immensely. Recently I purchased a Mini-Memory Module so that I could learn 9900 assembly language. I have tried to find some textbook which would teach 9900 assembly language to a beginner, but the few books which even discuss 9900 assembly language either do so on a very advanced level or in comparison with some other assembly language. The articles by John Clulow and Patricia Swift have helped some, but they are not really tutorials. Could 99'er Magazine see fit, perhaps in the near future, to run a series of 9900 assembly language tutorials for the beginner? I believe that with the advent of the Mini-Memory Module, there would be many of your readers interested in such a series.

Julian Wan
Ann Arbor, MI

Julian, we are running tutorials about the Mini-Memory and its Line-by-Line Assembler, and will continue to do so. Assembly Language programming is probably the most powerful form of programming but also is the most difficult to learn. We are continuing to battle this problem and are determined to find easier ways to teach this subject. So, please be patient.

Dear Sir:

As a kid (13 years old) I really enjoy my TI-99/4A. I look forward to every new edition of the 99'er Magazine. After experiencing the competition like Sync, Creative Computing, and Byte, I see no competition—99'er is the best!

Steve Nolan
Durant, OK

Thanks, Steve, we needed that! Everyone on the staff puts in super-human efforts to keep 99'er top quality and make it better. Your kind words, along with all the others, really makes it seem worthwhile!

Dear Sir:

Please would you let me know whether there is any publication which provides "translations" for commands in other forms of BASIC into TI BASIC. I believe some of these may have been published in a previous issue of the "99'er."

Keith A. Martin
Etobicoke, Ontario, CANADA

You are right, Keith. We published hints for translating APPLESOFT BASIC (Vol. 1, No. 3) and TRS80 BASIC (Vol. 1, No. 2). Unfortunately, these are now out of print. You may have luck finding these in libraries or local user's groups. Our new book, The Best of 99'er—Vol. 1 (available next month) will contain both of these articles.

Dear Sir:

About two weeks prior to writing this letter, I managed to purchase Extended BASIC for my TI-99/4A computer. After a bit of reading in the new manual and a bit of experimenting, I started CALL PEEKing into the machine's memory. Unfortunately, I have not been able to find any information about what system is being used or how information is stored in ROM or RAM in this computer.

I no doubt am puzzled as many other Extended BASIC users are about this matter. I was hoping that you could shed some light on this interesting subject, including where the neccessary information could be found. This could also be a good subject to do a tutorial on in your superb magazine. I unfortunately do not as yet have a subscription to your magazine, but it is coming in the near future. The issue I have now is Vol. 1, No. 4, borrowed from a friend, and I have been through it no less than forty times. Keep up the good work!

Below I have enclosed a small portion of the CALL PEEKs I have copied from my machine, and the short program I used to get them:

```
1   A=0
2  FOR B=A TO A+9 : : CALL PEEK(B,C) :
   : PRINT B;C : : NEXT B
3  CALL KEY(0,K,S)
4  IF S=0 THEN 3
5  A=A+10
6  GOTO 2
```

```
        0   1   2   3   4   5   6   7   8   9
00000 131 224   0  36 131 192   8 254 131 192
00010  10 120  48 170   4  96   2 178   0   8
00020  30   0   4  96   0 122  30   0   4  96
00030   0 120   4  96   4 176   2  13 152   0
00040   2  14   1   0   2  15 140   2   2   0
```

Robert Alan York
Penticton, BC CANADA

The information you seek, Robert, may be found in the TI Editor/Assembler manual that can be purchased (from TI) separately from the Command Cartridge. The interior of the machine is very complex, so be prepared to study the manual quite carefully.

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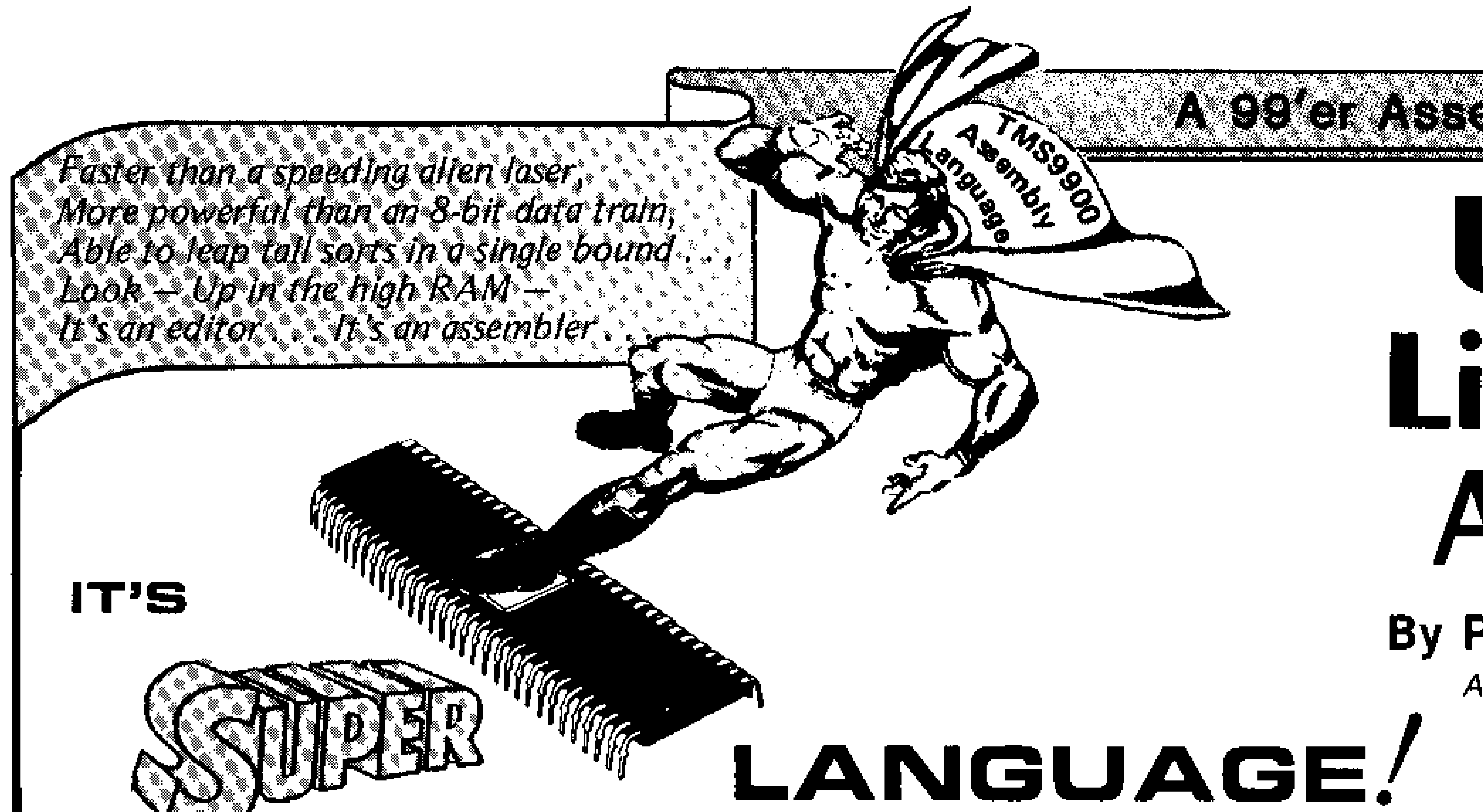
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Using the Line-By-Line Assembler

By Patricia Swift

Assembly Language Editor (The Human One)

TI's Line-By-Line Assembler, part of the Mini-Memory Command Module, is just the thing for people who want to write their own Assembly Language programs on the TI-99/4A without a large investment in hardware.

Besides the console and the Mini-Memory, all you need are a cassette recorder and cable. If you're not already familiar with the structure of the TI-99/4A and TMS9900 Assembly Language, it is helpful to have an Editor/Assembler Owners Manual.

The Line-By-Line Assembler puts together each source statement instantly upon entry. Syntax errors are rejected right away. The programmer can actually see the machine code generated from each source statement, plus the location counter. These features make the Line-By-Line Assembler an excellent tool for learning TMS9900 Assembly Language. It gives you a deeper understanding than the Editor/Assembler does.

There are limitations, though. It is difficult (sometimes impossible) to insert a statement into the middle of a program—unless the old and new statements are the same length in machine language. And neither is your source program preserved, except for the last few screens in a session. All this points to the near impossibility of composing programs as you go along, so you find yourself coding each program completely before even starting to enter it. Another big limitation of the Line-By-Line Assembler is the size of programs it can create—especially if you're without the 32K expansion memory.

Language Differences

The Line-By-Line Assembler uses the same instruction opcodes as the Editor/Assembler, with identical mnemonics. This means that the action codes for the microprocessor, such as **A** for Add Words and **MOVB** for Move Byte, are the same.

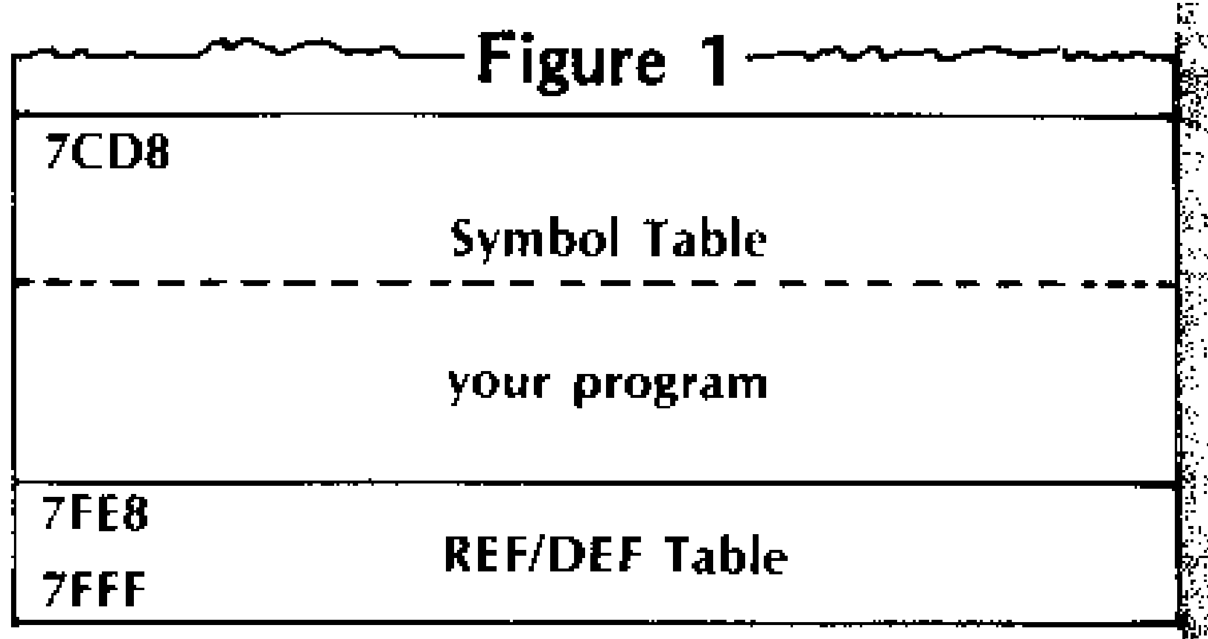
But the Line-By-Line Assembler has only 7 assembler directives, while the Editor/Assembler has about 28. Assembler directives are entered in the opcode field, but they represent instructions to the assembler rather than to the TMS9900. The 7 assembler directives implemented in the Line-by-Line Assembler are: **AORG**, **BSS**, **DATA**, **END**, **EQU**, **SYM**, and **TEXT**. Notably absent are **DEF**, **REF** (external **DEF**inition and **REF**erence), **BYTE**, and **EVEN** (intialize byte of storage and align to a word boundary). Since the Line-By-Line Assembler does not have a linker, **DEF** and **REF** are not sorely missed. The Line-By-Line Assembler forces you to initialize data areas in full word (2-byte) increments, so the **EVEN** directive is not needed anyway.

Labels used with the Line-By-Line Assembler must be one or two bytes long. This saves room in the Symbol Table, for storing labels and their corresponding addresses or values. Each Symbol Table entry is only four bytes long.

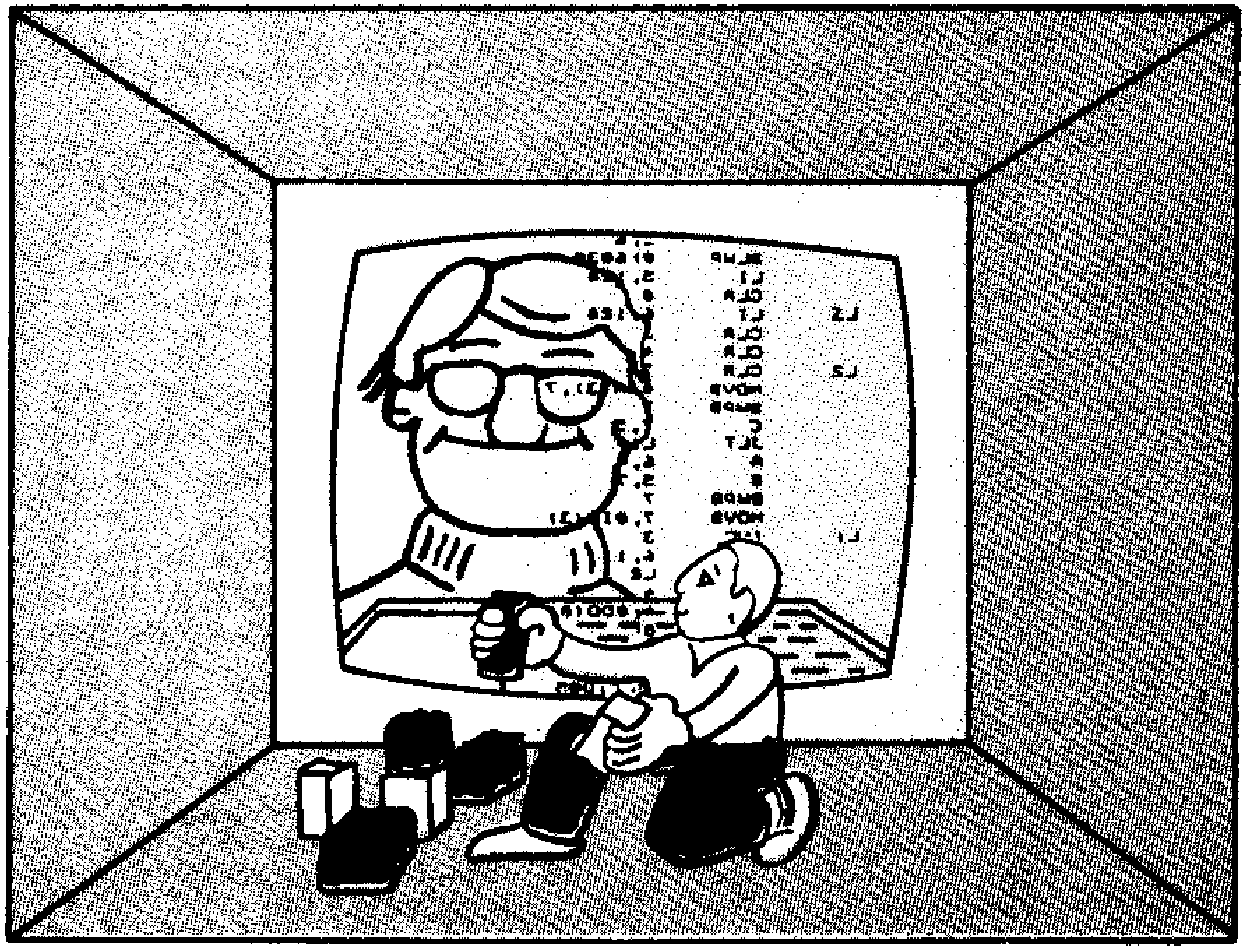
Deciding Where To Start

When you invoke the Line-By-Line Assembler by selecting RUN from the Mini-Memory menu and entering program OLD or NEW, the system will start off at the default location >7D00. You might not want to start your program there.

Figure 1



Refer to the portion of Mini-Memory RAM shown in Figure 1. The Symbol Table starts at >7CD8 and grows toward >7FFF. Each Symbol Table entry occupies four bytes, plus the four bytes of zeroes added by the system as the last entry. This means that if your program starts at >7D00, your Symbol Table will have room for 9 labels. If you intend to use more than 9 labels, then you should start your program after >7D00, or the Symbol Table will write over the beginning of your program. If you have fewer than 9 labels, then you will be wasting RAM by starting your program at >7D00. In general:



Program start address = >7CD8 + 4 * (# of labels + 1)
for the best memory usage.

The Assembler directive **AORG** is handy for putting this idea into action. If you want to start your program at address >7D1E, then enter **AORG** >7D1E. You'll see the location counter change to the value you entered, and you'll be ready to start your program.

You can see that it is wise to keep your labels to a minimum in order to maximize space. This means avoiding the assembler directive **EQU**, and coding those values directly as operands. You can keep from using positional labels for tight loops by means of the symbol $, (contents of the location counter). The two code segments

```
     LI 3,100    :  LI 3,100
P1   DEC 3       or DEC 3
     JNE P1      :  JNE $-2
```

have exactly the same effect, but the one on the right doesn't use a label nor make an entry in the Symbol Table. Similarly,

```
B1   EQU >6024 :
     ...      and
     BLWP @B1  :  BLWP @>6024
```

are equivalent in meaning.

Entering Assembler Statements

Statements are organized as usual: optional label, opcode, and optional operands. If a statement has no label, first type a space; if a statement has a label, type it followed by a space. Type the opcode next, then a space, and then the operands. Don't even try to align your source statements—you can't, and it doesn't matter anyway. After you have typed the statement, press enter. The Line-By-Line Assembler converts your statement to machine code, and places you at the correct spot to enter the next statement.

Don't be surprised if you're entering data and the Line-By-Line Assembler title screen suddenly re-appears. This only means that you're back at the beginning of the text buffer. Check your location counter and proceed with confidence.

The Line-By-Line Assembler allows references to labels defined earlier and labels yet to be defined. By the time you've finished entering your program, all labels referenced must be defined. To check up on yourself before ending your program (or anytime while you're entering the program), use the assembler directive **SYM**. The system will immediately display your Symbol Table, broken down into defined and undefined labels. Never **END** a program until **SYM** shows no undefined references or it won't run properly.

Executing Your Program

Once you have entered your program and **END**ed it with no errors, there are at least three ways to execute it:

Continued on p. 57

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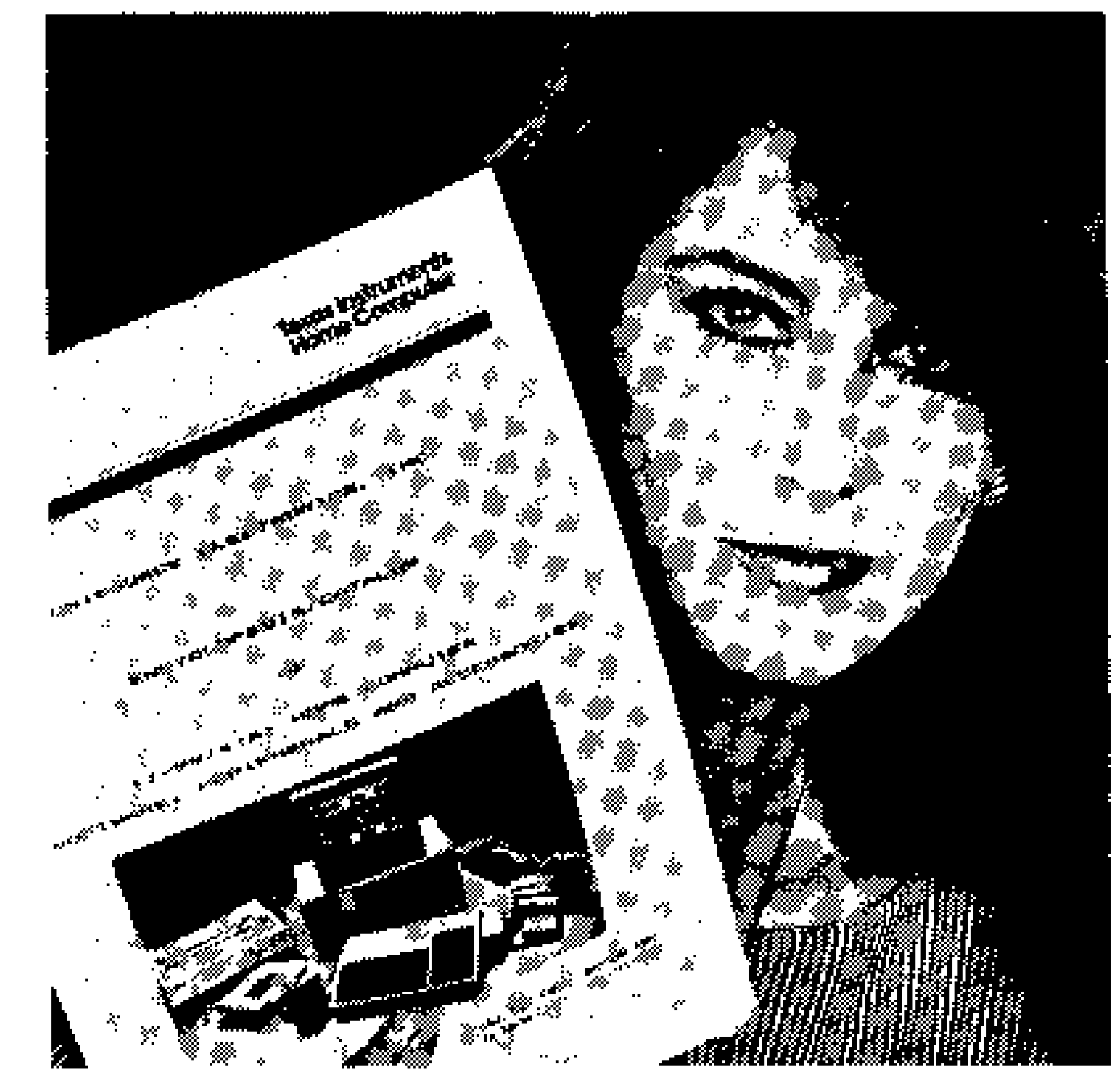

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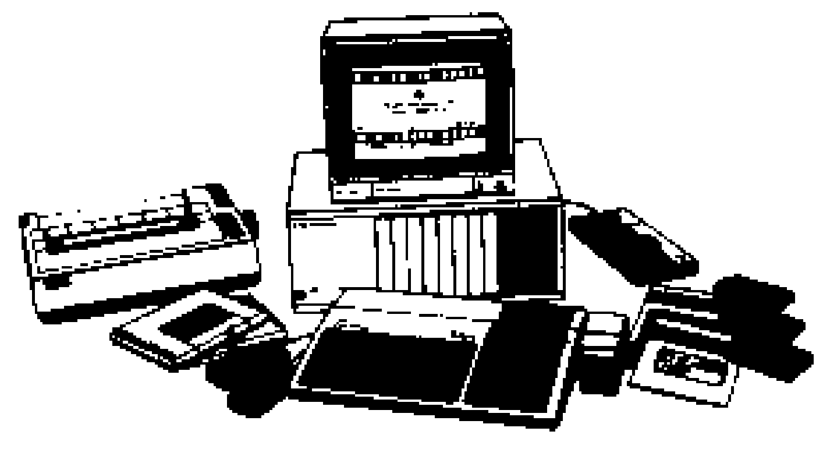

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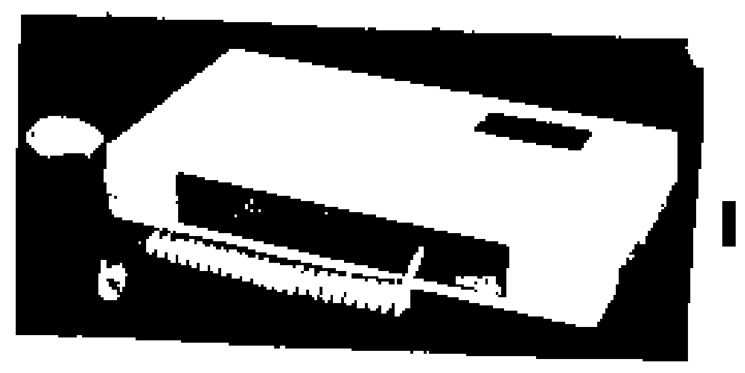

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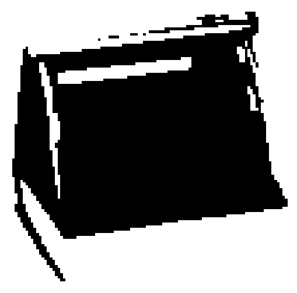

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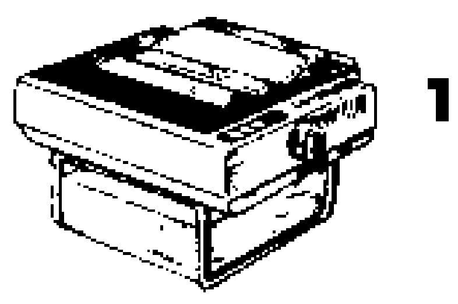

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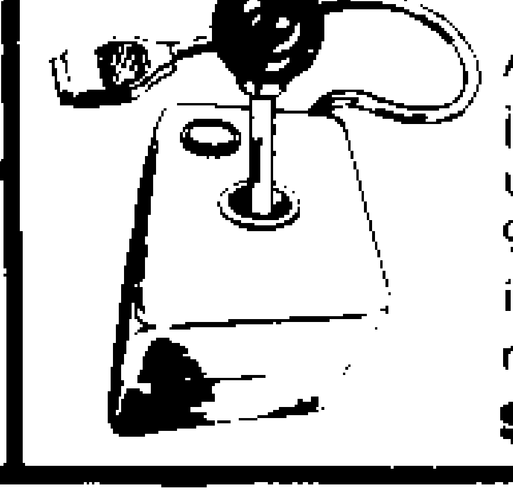

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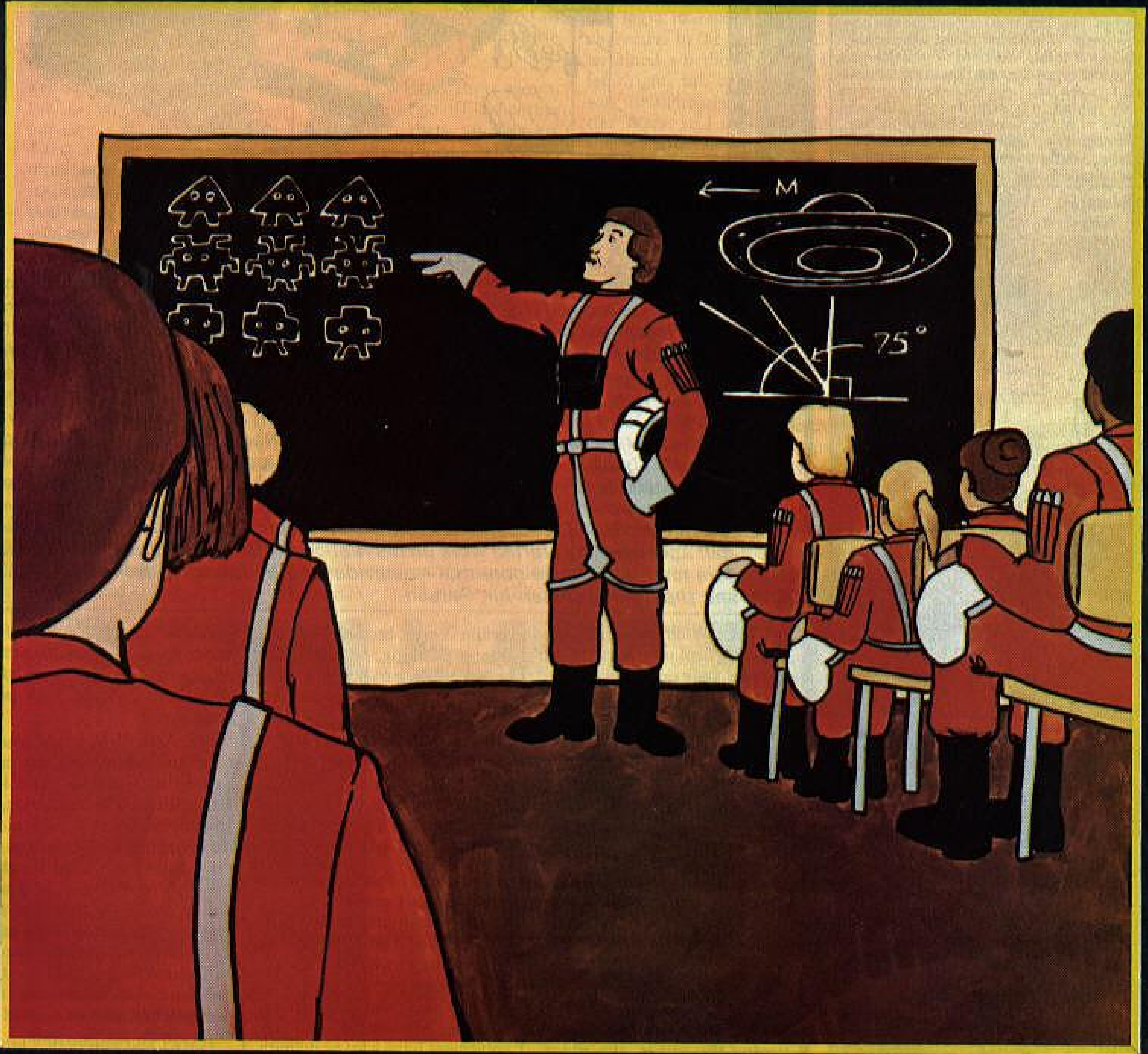

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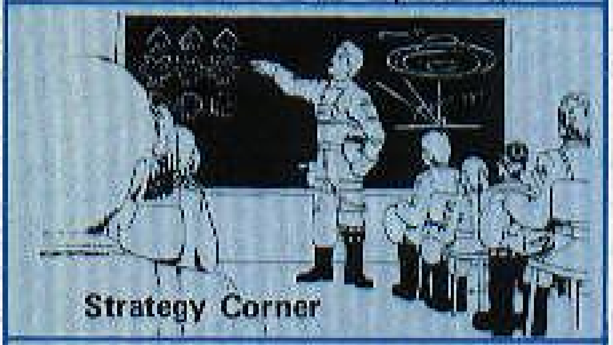

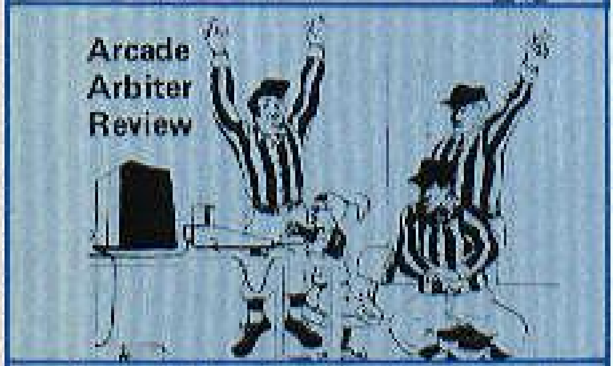

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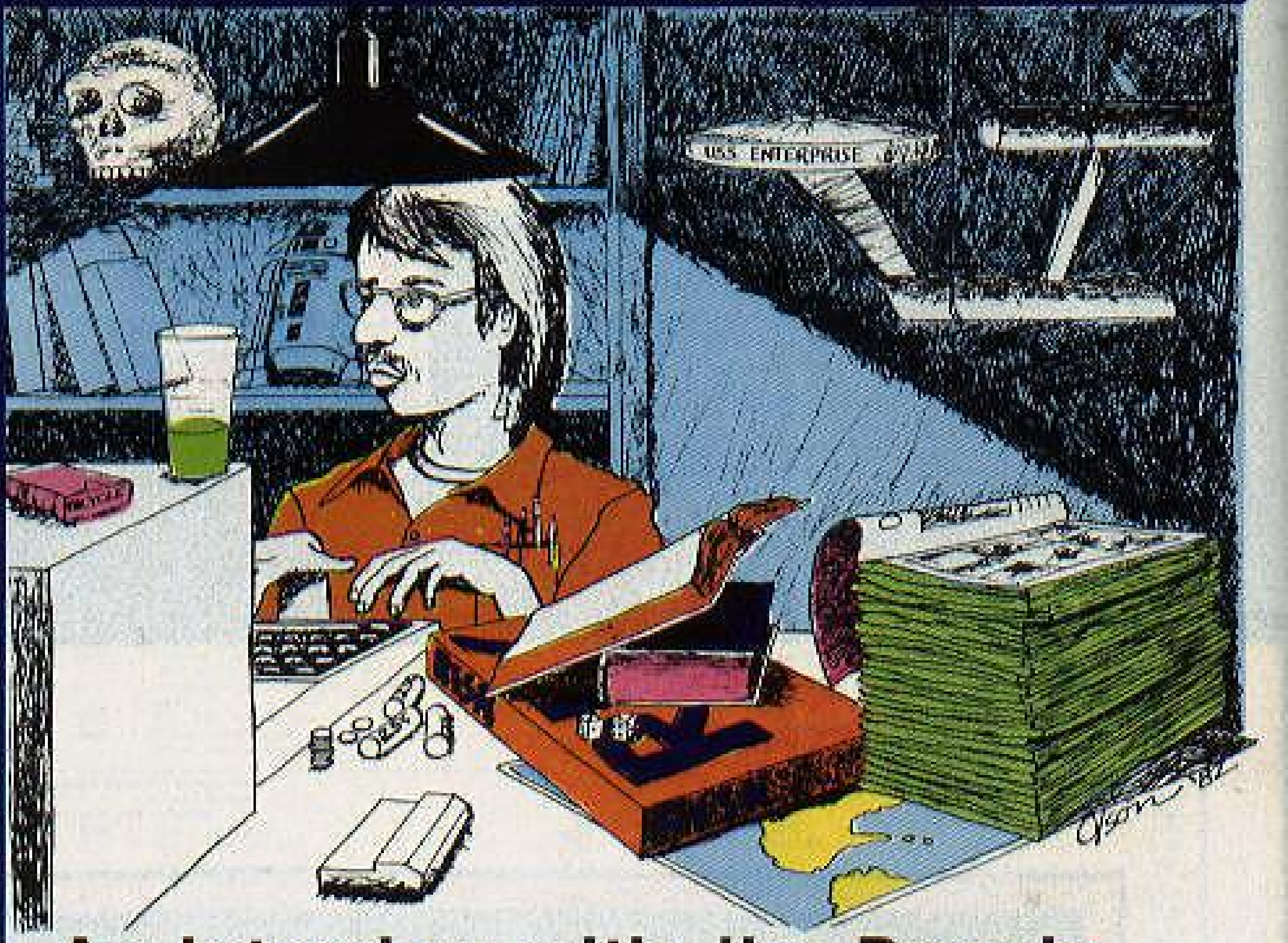


An Interview with Jim Dramis

Game Designer and Programmer Extraordinaire

By Gary M. Kaplan

***BACKGROUND:** Jim Dramis, a 32-year-old programmer with Texas Instruments, is no the kind of person who you'd picture as a whiz-bang arcade game designer. As a forme high school math teacher and insurance agent, the mild-mannered Dramis was fa removed from the fantasy world of space ships, lasers, racing cars, and hungry video creatures. An Ohioan by birth, he completed his B.S. in mathematics at Kent State University, and went on to a brief stint as a manufacturing supervisor at TI. From there, Dramis worked for a couple of years as a special agent for an insurance company, then switched careers again and went into teaching. After another two-year interlude, 1979 found him back at TI, this time working as a programmer analyst on minicomputers being used for the calculator and watch repair system. From this support environment, Dramis transferred to TI's Consumer Products Group, where he got involved in some Extended BASIC educational software development. But it wasn't until a year-and-a-half ago, when he started work on his first game,* Car Wars, *that Dramis began to explore his real creative potential—as evidenced by follow-up work with* Munch Man, *and the new TI smash hit,* Parsec.

GMK: *What influence does your mathematics background have on your present work as a game designer and programmer?*

JD: I think that the logic and thought process that one develops in going through the rigors of mathematics certainly does help in game design and the programming of computers; they seem to go hand in hand.

GMK: *What about your experience as a teacher?*

JD: My teaching experience has helped me instruct other programmers here at TI. In designing the games, the educational background helps to a certain degree, because I'm constantly thinking, "How is the audience going to perceive what I'm doing?" You try not to make the game too complex, but rather, interesting and a good experience.

GMK: *How do you feel about games as a form of entertainment and enrichment?*

JD: Well, I think games add more to your enrichment and learning than just hand-eye coordination and skills. We're just now starting to observe the effect of game playing on the entire learning and educational process. Motivation and involvement have a lot to do with it.

GMK: *How do you fee about yourself—playing games all day for a living. . .and wha about the children who pla your games?*

JD: Actually it might soun kind of funny, but to me, *writing* the game is more fu than sitting down and *playing* i for hours. There's a lot mor that goes into designing a gam than meets the eye. As for children, there was one girl I wa talking to who told me sh played *Munch Man* hours eac day and scored 294,000 points It's a good feeling to know tha someone out there likes th product that you've created.

GMK: *Did you play a lot o games as a child?*

JD: I played cards a lot. Board games too. This interest and intrigue with numbers and logic from an early age might have contributed to my interest in games. I think *that*—especially in the environment that I'm working in—is interesting because you're trying to push the machine at its ultimate limits. You're trying to muster everything graphically, speed-wise, logic-wise—out of the machine that you possibly can. The limit there sometimes is just the limit of the programmer's imagination and skills. It's pretty challenging.

GMK: *Is the process of designing a game a game in itself?*

JD: Yes, there's a certain tension, a certain risk-reward, and there's a goal. Some of these key elements you find in the actual game that you produce—you have a certain tension about doing a game because in your mind there are four or five obstacles that you know have to be overcome, and you're not sure you can; it's kind of exciting each day—you never know how far you're going to get. There's a certain risk because you could spend six months on a project, and it could very easily be a total disaster. Sometimes there's a fine line between a great game and a total wipe-out. There's also a goal—finishing the project—that means making sure it is a marketable, bug-free product. So you're right—there is a game in creating games.

GMK: *How much of* Car Wars *and* Munch Man *did you actually do?*

JD: *Car Wars* and *Munch Man* were basically my own—games that I was responsible for and did the programming on. *Car Wars*, my first game, was one GROM; that was all programmed in GPL. Prior to actually starting work on the game, I attended GPL classes here and took a couple of weeks just to familiarize myself with the GPL manual and the architecture of the Home Computer. Basically I learned the GPL language by *doing* the programming for *Car Wars*. Similarly, with *Munch Man*, I learned 9900 code [Assembly Language].

GMK: *Can you give us an account of the evolution of* Car Wars *from idea to finished program?*

JD: In a lot of these games, we don't just go off in a corner and dream them up. We get good suggestions, help, and ideas from a lot of different people—even systems programmers on how to improve or write a subroutine. I had the basic game design idea, and the first thing I wanted to make sure was that GPL had enough speed to handle the motion, or whether I would have to use automotion. In this program, I did not use automotion of sprites. Those cars are double-sized, magnified sprites. I moved them one, two and four-pixel increments myself.

One of the main problems in the game was the logic. For instance, the track has all different characters that tell me whether the car can turn left, right, or change lanes. Once I got that programmed and working well, the rest of the game was really just polishing up—making the track look better, adding scoring and color, extra computer cars, etc. The whole effort took two and a half to three months of programming.

GMK: *Now, let's get into* Munch Man. *Why did you decide to do a game like that?*

JD: I wanted to take advantage of our machine's color graphics and sprites. A maze-type game seemed to offer interesting possibilities. The logic in *Munch Man* is similar to *Car Wars*, where I was moving the sprites pixel by pixel; I needed the logic to recognize special characters in the maze that determined whether I could go left, right, up, or down. This was the same obstacle I had in *Car Wars*, so I took the main *Car Wars* routine and converted it from GPL to 9900 code. That took about a month. Then I tried to design some type of maze that was interesting and would take advantage of our graphics and color.

GMK: *Did you run into any major problems where outside help was needed?*

JD: There weren't any major problems. I only needed help on a few subroutines. No one can be expected to know everything about the machine, so when someone runs into a problem, he'll take a lot of suggestions from fellow programmers because often they have gone through the same thing in another project. In fact, they may already have a subroutine that you can take and just modify. I used at least three or four subroutines that were in *TI Invaders*.

GMK: *During the final polishing and testing of* Munch Man, *a lot of your fellow programmers must have offered their criticism—how did you take this?*

JD: Well, there was a first, slightly unfavorable reaction because of the blood, sweat and tears already put into the game—I tended to take it personally. But there are a lot of us that have gotten used to criticism. In fact, many of us now enjoy the interaction. You can take others' ideas or not—it's ultimately up to you. It doesn't hurt to have someone be very critical. Most of the time it will help you. There was a lot of what we call "tweaking" the final process of the package—the five or six parameters of *Munch Man* that had to be human factored. It certainly did help to have people critical of the fairness, speed, difficulty, and risk-reward factors in the game, so that I could successfully fine tune it.

GMK: *Were there any major changes from what you thought was the finished version to the actual game release?*

JD: Some of the programmers felt that the learning curve as relating to the beginning difficulty of the game was not quite fair. Following their suggestions, I made the game less difficult at first. It kind of gives the player a bit of a break—a

Continued on p. 38

" . . . to me, writing the game is more fun than sitting down and playing it for hours . . . "

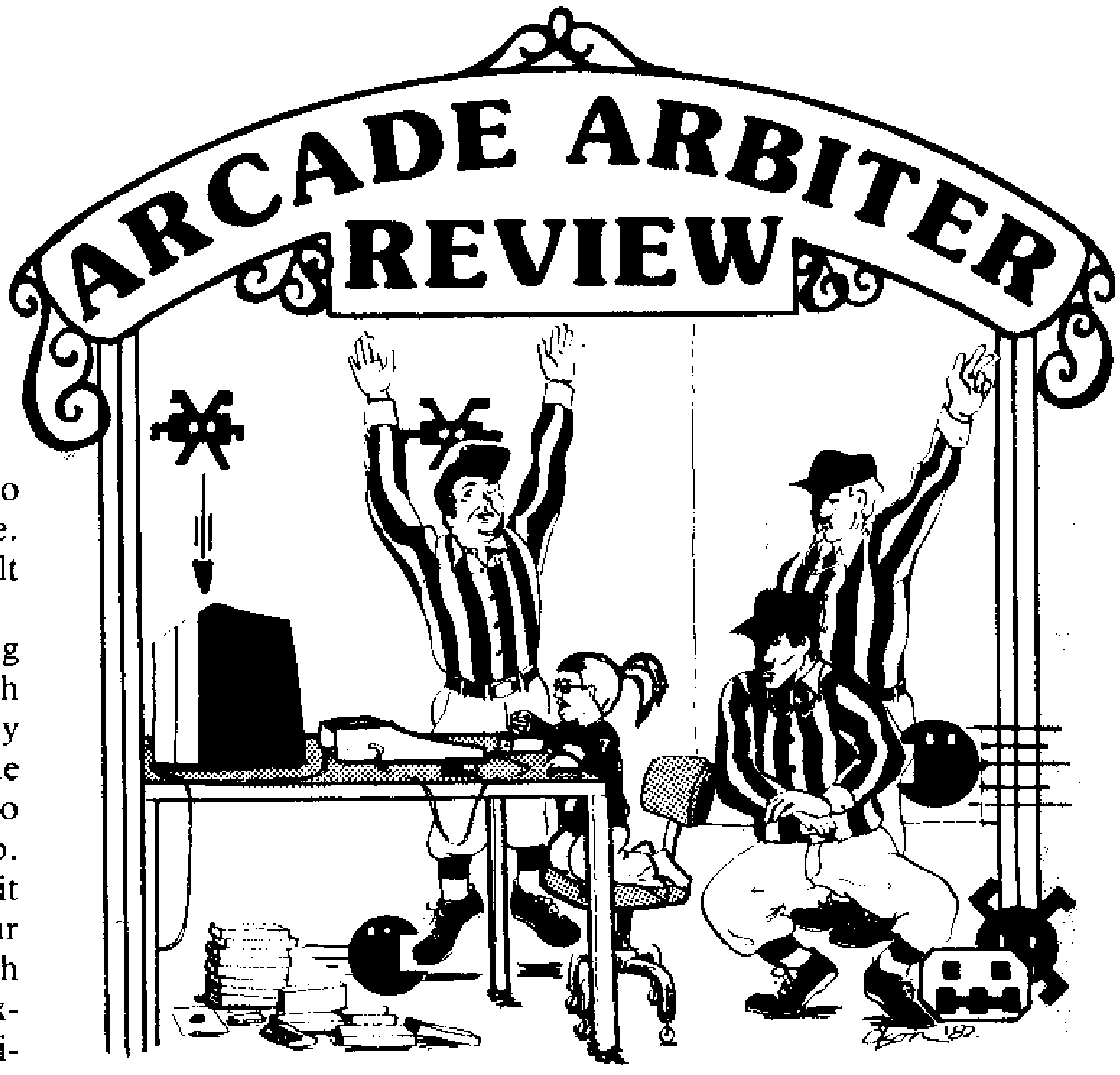
" . . . my top score [on Parsec] is only about 77,000. So—I haven't even broken 100,000 yet!"

"It's a good feeling to know that someone out there likes the product that you've created."

Death Drones

Reviewed By Steve Schwartz

Game Review Editor



Author:	**Mr. Moon**
Program Type:	**Arcade "Save the Earth" Game**
Language	**TI Console BASIC**
Distributor:	**Moonbeam Software** **2 Bridge St.** **Northampton, MA 01060**
Price:	**$14.95 cassette or disk**

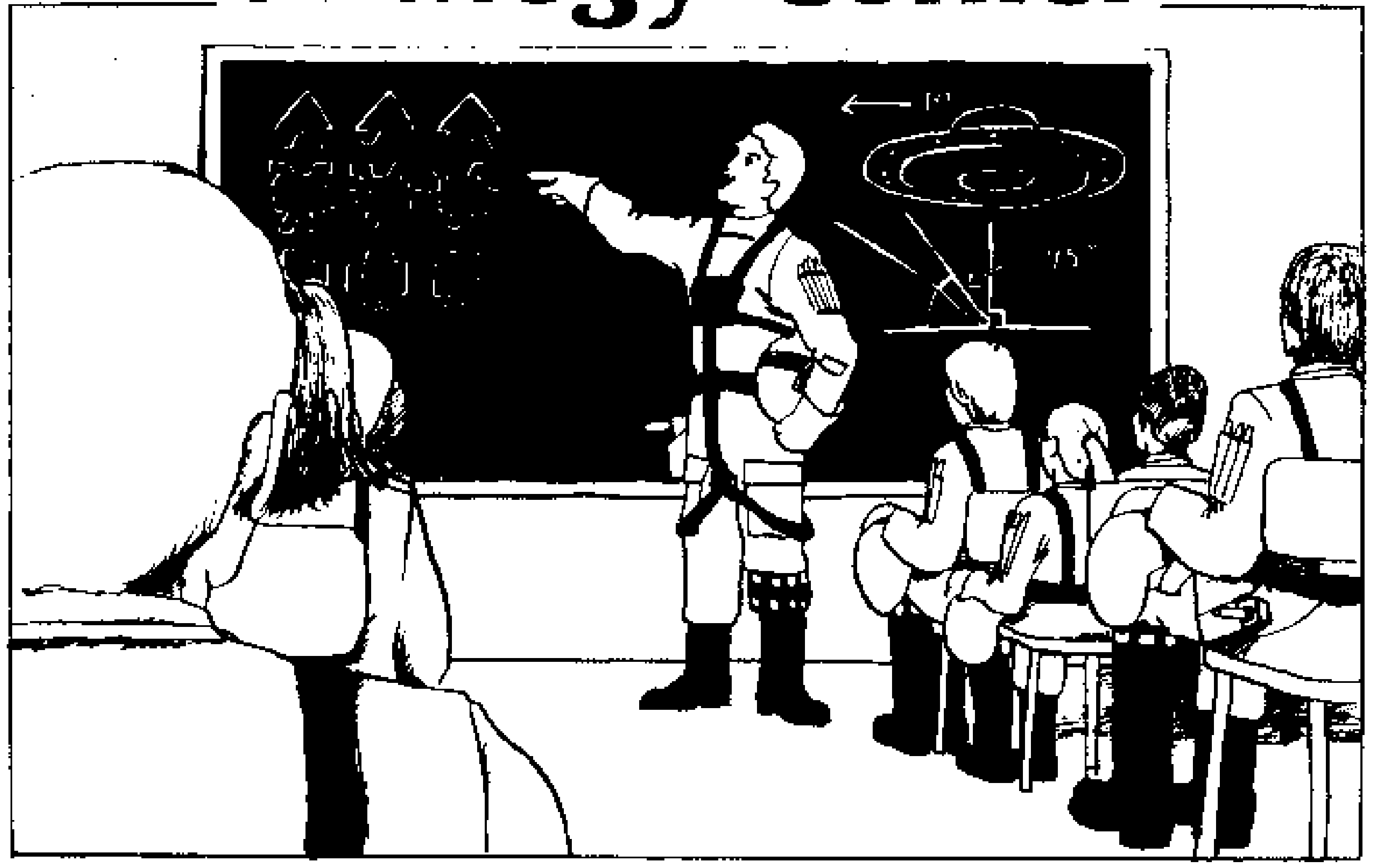
If you're one of those "old timers" who believe that fast-action, arcade-style games for a "bare bones" system [i.e., console only—Ed.] only exist in Command Cartridge form, you haven't yet seen *Death Drones*, the newest arcade game offering from Moonbeam Software.

Since the game is programmed in TI console BASIC, *Death Drones* caught me off guard with its speed and special effects. Before I knew what hit me, I was thoroughly trounced by the enemy, my nuclear power plant was bombed to smithereens, and my city reduced to rubble by a nuclear explosion! Not being the kind of person to meekly accept defeat, I immediately typed "Y" and tried again. Sad to say, I didn't do much better the second time. This is definitely a difficult game to master.

The game begins by building a futuristic city, complete with nuclear power plant. One by one, the *Death Drones* invade your air space, as you try to blast them from your lone ship. When a drone shoots you, it then drops a bomb on your nuclear plant. After six such bombs, your nuclear plant explodes, taking the rest of the city with it in an impressive graphic/sound-effects show. (You may be "entertained" often with that show, I'm afraid.) But if you accumulate 1,000 points by shooting down the drones, your nuclear plant will be rebuilt . . . and you'll have to defend your city from another bunch of drones.

The game comes in both joystick and keyboard versions, plus the option of playing it in regular or Extended BASIC. Although a good deal smoother in Extended BASIC, it's also faster, making the challenge a little more difficult. Some people will find this game much too difficult—perhaps even frustrating—but patience, perseverance and quick wits are likely to pay off in the end.

Strategy Corner



TI Invaders

By Scott Emery

Worthington, OH 43085

As all fellow *TI Invaders* addicts know, the object of the game is simple: shoot down the Invaders and score points. And like all arcade games, the Invaders don't stop coming. I hope the following suggestions will raise your score substantially, and let you meet new kinds of Invaders you may have never seen before.

When you start your game, you are faced with a fleet of enemies eleven creatures wide and five creatures deep, moving at a slow pace and not firing (unless you have already moved or fired). The first thing you should do is cut the fleet to a reasonable size. Move *opposite* from the direction the Invaders are moving, and start shooting at the third-from-last column. After you accomplish that, shoot down the next two columns that are now set off from the rest of the fleet. If you have done that correctly, the Invaders should now be (or about to be) marching towards you.

Now try to destroy every creature in the first column marching toward you. Don't be upset if one of the top Invaders gets by. Just be sure to get him before he reaches the end of the screen and causes the enemy to drop another row. Keep doing this until the fleet is made up of four or five columns with two to five Invaders in each.

By now you already should have hit the yellow control ship that has passed over the fleet. If the second control ship hasn't passed by yet, destroy only one row of Invaders each time they drop a level, until the control comes. (See Suggestion #1 for more on this.) Then promptly destroy the remaining Invaders. (See Suggestion #2.)

After you destroy each fleet of Invaders, a red spaceship passes by—a target to be hit as many times as possible. When the spaceship comes onto the screen, *do not* hit it immediately. Move to the other side of the screen and shoot your target when it comes into range. Then you should move to the other side and fire until the ship escapes. Incidentally, the maximum value of the ship is 500. After that, the saucer value is displayed as XXX.

I personally have found that these suggestions work fine until the seventh board and the Green Flashers—you must accept the frustration of shots passing through the Green Flashers. (See Suggestion #3.)

Here are some other suggestions for increasing your TI Invaders skill:

Suggestion #1: When the yellow control ship comes around for the second or third time, try to leave three or more Invaders on the screen, too. With only two Invaders on the screen, the ship moves erratically; only one Invader makes the ship move at high speed.

Suggestion #2: When one or two Invaders are left, you can try hiding behind a shield and shooting at them, or shooting out in the open. When you are shooting out in the open and the Invaders open fire, don't move your missile base around. Only jump base when you know a shot is coming at you. This will decrease your chance of running into a laser.

Suggestion #3: If green or blue flashers are up high on the screen, shoot at them when they are OFF—by the time the shot reaches them, they will be ON.

Suggestion #4: Try to keep relaxed. I get some of my best scores lounging in a chair. Also try to avoid blinking during the heat of the battle!

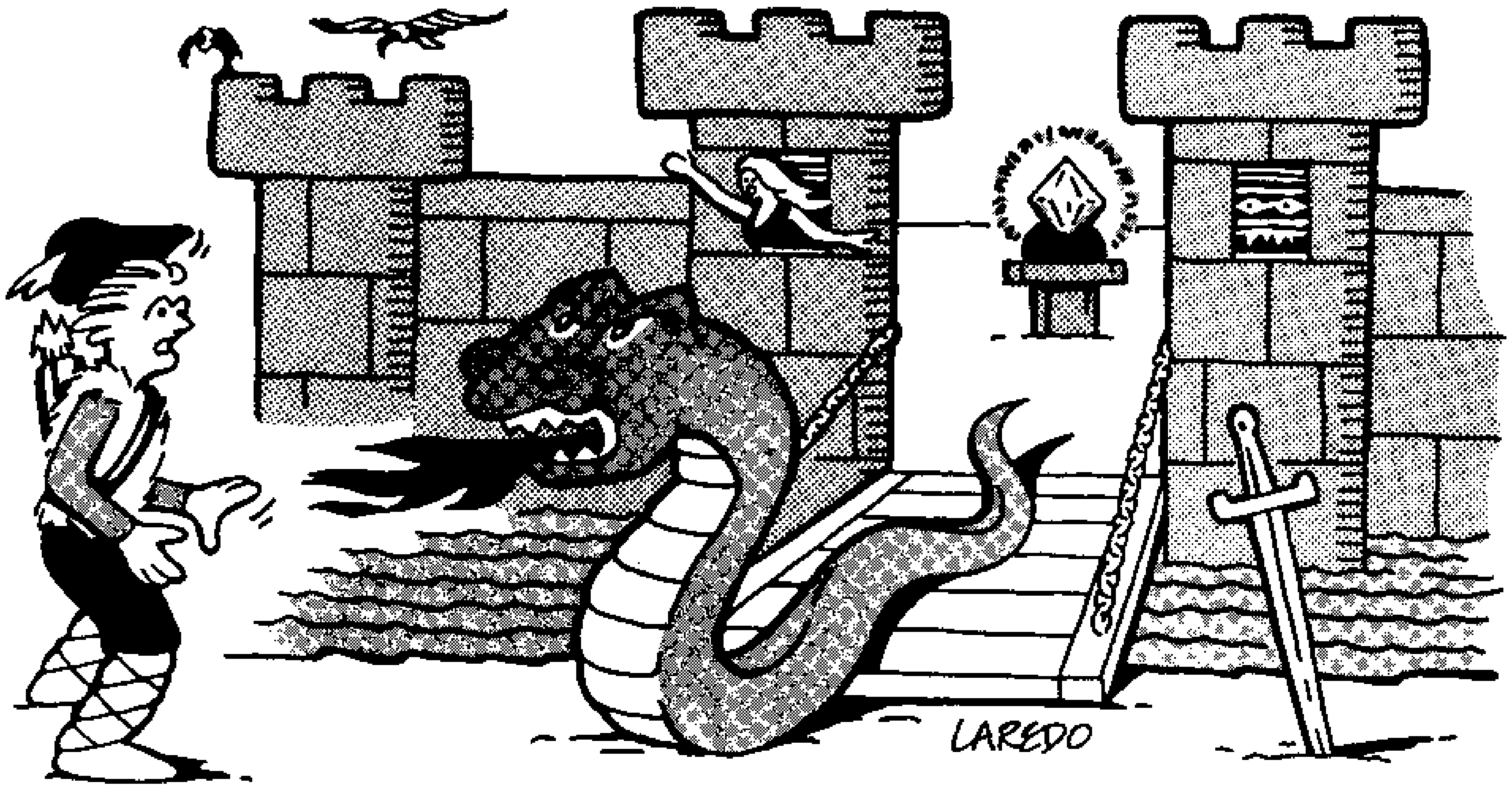
I hope these observations will heighten your enjoyment of the game. They helped me to the fourteenth board and 28,028 points. Good luck!

The Joy of Adventuring

*I'm in a flat in London. Visible items are: Flight of stairs, sign saying "Bring *Treasures* here and say 'SCORE' ", bottle of rum, rug, safety sneakers, sack of crackers. I'm carrying: nothing.*

By Samuel D. Pincus
Contributing Editor

PART 1



To us adventure game enthusiasts, the above is immediately recognizable as the first scene from *Pirate's Cove*, part of TI's ADVENTURE software package.

What is an adventure? How do you play (or even write) one? Before answering these questions, I'd like briefly to tell how the whole thing got started.

When large computers were developed in the 1960's, the programmers were real enthusiasts. It was more than just a job—they would rather work on a computer than do anything else in the world. On their off hours, they would develop new uses for a computer—uses not really expected by their clients. In short, they used the computers for game playing. And these games grew more and more complex.

One type of game used the computer to send enemy aliens toward a starship (i.e., STARTREK). Another type set up a scenario, with its hero solving problems and killing monsters in order to stay alive. This new "Adventure" genre required large computers (with over 300,000 bytes of memory) to keep track of everything. These days, of course, the games have been transferred to small microcomputers (with only 16,000 bytes).

A Sword & Sorcery Adventure

So far, adventures come in two main forms. The first is something I call "Sword and Sorcery." In this kind of adventure, your task (such as to rescue a princess or recapture a magic diamond) may take you through a cave or castle filled with, say, all sorts of monsters and mysterious beings. You may go alone or as the chief of a band of adventurers.

In some adventures with several players, each person is a member of a band trying to track down the quarry. The mainstay of these adventures is monster-killing. The challenge is to keep track of your (and your fellow adventurers') strength and equipment, plus the same for the opposing monsters. You must always know when to fight and when to run.

Of course, there is more to the adventure than just fighting monsters. In order to reach your objective, there may be doors to unlock and cliffs to climb, while you try to strengthen your abilities through your actions. For example, you may kill an ogre and rob his gold. Using the gold, you may buy a strength potion (if you haggle successfully with a street vendor!). In any case, you must pay close attention to everything around

Continued on p. 67

Adventure Registry

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Thief

An Adventure Successfully Completed

By Steve Schwartz
99'er Game Review Editor

A wonderful graphic adventure game called *Thief* will surely bring out the crook in you. As Stealthful Smith, burglar extraordinaire, you are breaking into the home of zillionaire Howard Huge. The object of the game is simple—to take the money and run . . . in the shortest time.

You control your movement from room to room with the joystick. It's a big house with 11 locations in all, including a "secret room" I won't tell you about. Each room is filled with beautifully-rendered furniture—just what you'd expect in a zillionaire's house. You are looking for a key to a room with a safe, and a piece of paper with the safe's combination. To search a household object for the paper or key, you move a square onto it and press "fire." That's when you find out the name of the object, and whether or not it holds what you need.

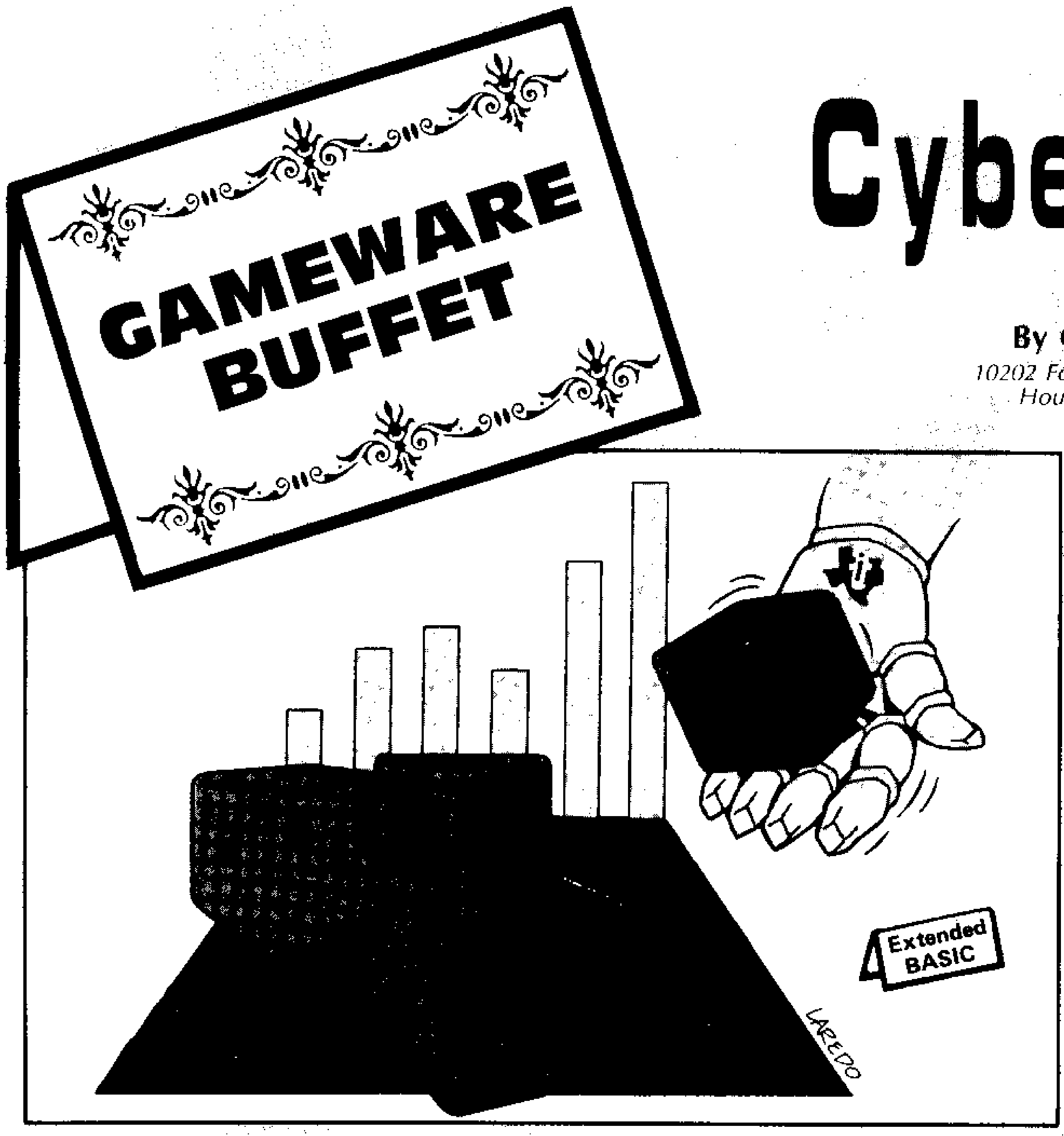
Each time you play, the location of the key and paper is different, and so is the three-digit combination. There's a lot of heart-pounding suspense as you hurry to beat your previous time score. But you'd better not hurry so much that you get careless and trip the alarm.

Now where's that secret combination? I've already found the key to the safe's room. Time ticks away relentlessly while I hurry on my search. I can't find that paper anywhere in the front room or living room. Running through the doorway into the kitchen, I examine the kitchen table and the refrigerator. Wait a minute—here it is on the dishwasher! Memorizing the three-digit combo, I make a mad dash for the stairs and then through the upstairs hallway. I unlock the door with my key, and find myself confronting an intricate maze. I've got to be careful not to touch any of the walls, knowing they are connected to the alarm system. Threading my way with great care through the maze, I am asked for the combination to disarm the safe's alarm system. I quickly punch in 378 and continue through the maze toward the safe. Making a quick turn, however, I accidentally brush against a wall, setting off a piercing alarm and summoning the police. The judge gave me ten years! I've failed in my mission . . . at least until the next time I type RUN.

Thief by Tom Perkowitz is available in Extended BASIC for $7.95 on cassette, through Tomputer Software, 1550 Montgomery Drive, Deerfield, IL 60015.

Cyber-Dice

By Curt Garcia
10202 Forum Park Dr. #310
Houston, TX 77036



In the last year and a half I have been zapped, bombed, shot, and blasted into oblivion so often that I sometimes wonder what kind of magic glue holds me together. A person can fight off just so many space creatures before starting to feel like one himself. That's when I decided to write *Cyber-Dice*—a game that leaves you alive at the end . . .

Cyber-Dice is similar to the popular game *YAHTZEE* by the Milton Bradley Co., but with a new twist: Up to six people can play, and each person can play up to three games simultaneously. The object of the game is to roll four dice (supplied on the screen) and try to fill up your card (also on the screen) with higher scores than your opponents'.

The game is simple to learn with only a few keys used to control the play.

1-6	Selects the dice you wish to keep. By pressing the key which is equal in value to the dice you keep. These keys underline the dice, and the computer will not roll them again until the next turn.
0	Will clear all lines under your dice so that all four can be re-rolled.
A	Will place a line under all four dice, indicating that you wish to keep them all.
R n	For rolling a die you have already selected, but not necessarily all four, you can press "R" followed by a number from 1 to 6, indicating which dice you wish to get rid of.
SPACE	Computer rolls any dice without a line under them. You are limited to three rolls per turn.
E	Moves cursor up to select a category.
X	Moves cursor down.
S	Moves cursor to the left to select game (1 through 3) you wish to play for this turn.
D	Moves cursor to the right.
ENTER	Enters your turn in category and the game number you have selected.

The Rules of Play

1. Scoring in the upper section of the screen, ONES to SIXES. The score is equal to the total value of all dice of that denomination. A bonus of 35 points is given to a player whose upper section score is at least 53 points. Once all six categories are full, the score for each game is multiplied by the game number. For example, if you had 60 points on the upper section in game #3 you would receive 180 points.

2. Scoring on the lower section of the screen, TWO PAIR to CHANCE. The scoring in the bottom half of the game is as follows:

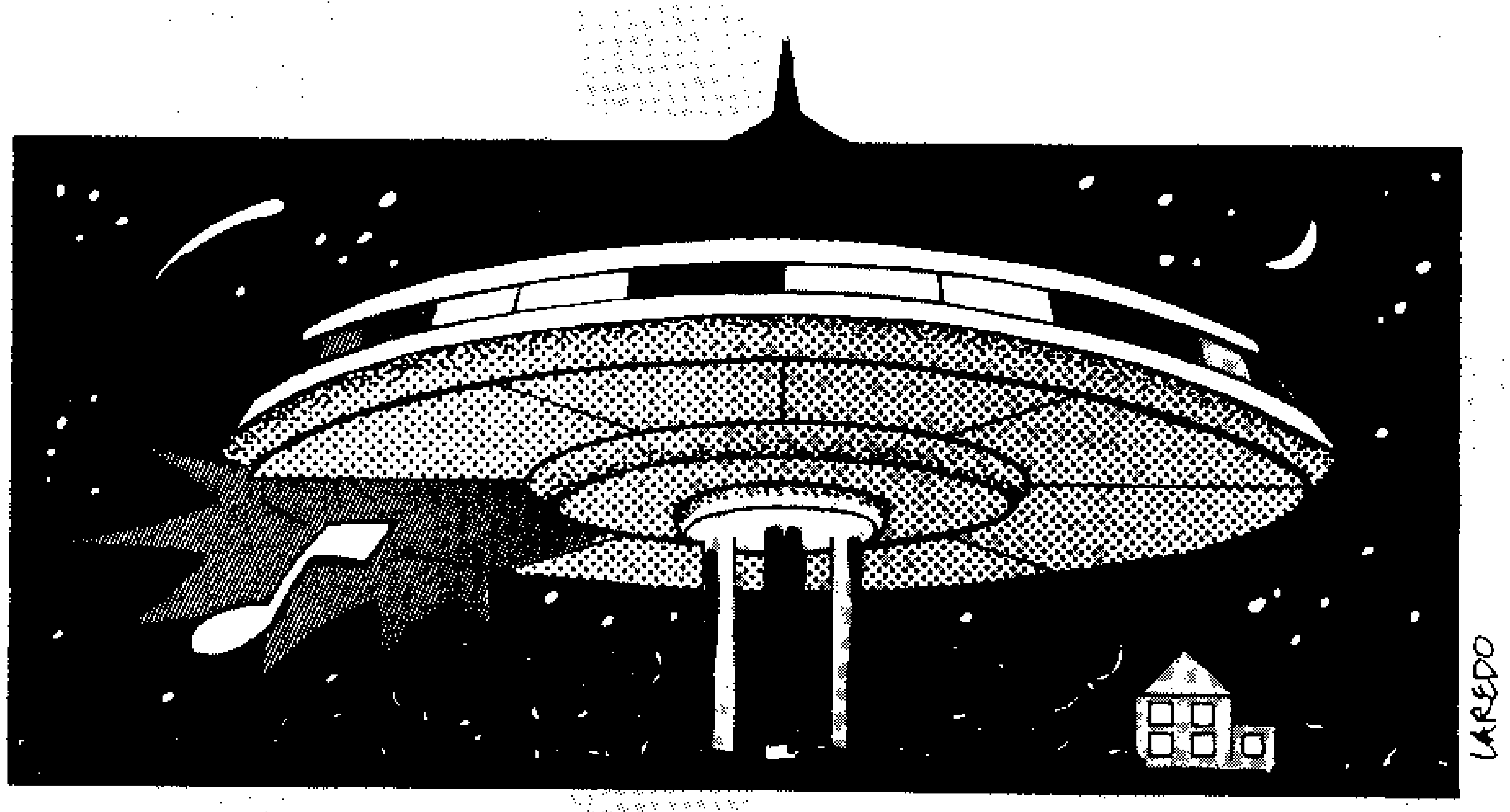
TWO PAIR	25 points
THREE OF A KIND	Total of all four dice.
CUBE	50 points
S.STRAIGHT	30 points
L.STRAIGHT	40 points
NO CHANCE	0 points
CHANCE	Total of all four dice.

3. TWO PAIR and THREE OF A KIND are self explanatory. A Small STRAIGHT is any three dice in numerical order. A Large STRAIGHT is all four dice in numerical order. The NO CHANCE category gives no points. This category is a last-chance reprieve from having to use a bad roll in a category which gives points. CHANCE will accept any combination of dice, and gives the player points for the total of all four dice.

4. Scoring for a *CUBE* is as follows:
   - A)If a player indicates an open *CUBE* scoring area, the *CUBE* will be scored there.
   - B)If a player indicates any other scoring location the computer will take over in the following manner:
     1) First the computer will look for an open *CUBE* scoring area. If it finds one, the score will go there.
     2) If all *CUBE* scoring locations are full, the score goes to the upper category equal to the dice value.
     3) If the upper section for that dice value is full, then you will be given a *JOKER*. The *JOKER* can be played on any lower section category.
   - C)If at any time you place 0 points in a *CUBE* scoring area, all future bonuses will be forfeited.

Close Encounters of the Simon Kind

By Garrett Mineo
829 East Crystal Court
Westwego, LA 70094



Somewhere in Mid-America—"Look, Martha. It's one of them flying saucers. What do you think they want."

"Well I don't know, George. Maybe they want to say something to us."

"But how do you get to 'em? Do you think they talk English?"

"No, dummy. Didn't you see Close Encounters of the Third Kind? Them aliens talk with music."

"Maybe if we show 'em how intelligent we are, they'll come out of their ship and visit with us."

Sound far-fetched? Well, after you've played *Close Encounters of the Simon Kind* you won't think so. The aliens want you to learn a series of tones and to play them back the way you hear them. If your visitors deem you worthy of their company, they will come out of their ship in a dazzling display of lights.

The aliens start you out slowly. At first you will be required to remember only one tone. Sound easy so far? Well just wait. If you get the first one right, the aliens will repeat it and add another tone to it. This continues until you start pulling your hair out, trying to keep track.

Remembering the tones has been simplified slightly with color graphics. The alien will display a different color for each tone. White, red, yellow, green, and blue can be entered simply by pressing one letter, such as W for white, and R for red. The screen also keeps you informed of the highest score for your present session.

EXPLANATION OF THE PROGRAM
Close Encounters of the Simon Kind

Line Nos.	
100-170	Rem statements.
180	Branch to program.
190-240	Subroutine to display text without scrolling the screen.
250-270	Initialize the screen.
280-370	Define characters, and colors.
380-420	Data for title page. Display title page.
430-500	Finish setting up title screen, while waiting for a key input.
510-690	Display instructions.
700-740	Check data statements.
750-1030	Define graphics characters.
1040-1080	Define colors.
1090-1250	Place alien ship and house on the screen.
1260-1320	Put shrubs, and trees on the ground.
1330-1350	Finish the alien ship.
1360-1370	Wait for key to continue.
1380-1700	Graphics and sound effects.
1710-1800	Display alien moving at the top of the screen.
1810-1950	Display score, and high game graphics.
1960-2120	Initialize variables.
2130-2410	Decode notes, and set variables accordingly.
2420-2530	Play notes, with colors flashing on the alien ship.
2540	Check for the end.
2550-2690	Input players response.
2700-3030	Decode players response, and play the tone.
3040-3090	response is wrong. Play low tone and branch to start over.
3100-3110	Display color of note player input at the bottom of the screen.
3120-3270	Subroutine to change variables.
3280-3300	End of the game.
3310-3350	Display the score.
3360-3420	New high score.
3430-3480	If score is equal to 20 then flash screen and branch to graphics display, for a visitation from alien.
3490-3520	Check score, and branch accordingly.
3530-3580	Change ship's color.
3590-3720	Display laser bolt.
3730-3780	Display transporter beam.
3790-3840	Display alien.
3850-3900	Play tone on the alien's ship.
3910-4000	Beam alien back up to the ship.
4010-4280	Play random tones on the ship.

Listing begins on p. 36

EXPLANATION OF THE PROGRAM
Cyber-Dice

Line Nos.	
100-150	REM statements.
160-170	Input option to use expansion memory.
180-260	Initialize variables. Display initial screen, and input number of players.
270	Input number of games.
280-300	Input players names.
310-330	Display instructions.
340-350	Initialize variables.
360-390	Display playing screen.
400	Initialize start of the game.
410	If more than one player display the new players score card.
420-430	Display the players name.
440-460	Control loop to roll the dice.
470-530	Generate dice graphics.
540-570	Read keyboard, and branch.
580-610	Re-select dice which have been selected.
620-640	Chose dice to keep.
650-670	Clear score card, reset variables.
680-710	Move cursor arrow.
720	All done with turn.
730	Check for the number of dice for each value. e.g., two three's, and two five's.
740	Check for *CUBE*.
750	Check for the category the dice are in.
760-770	Check for *TWO PAIR*.
780-900	Display *CUBE* graphics, and control *CUBE* options.
910-930	Input category to use the *JOKER*.
940-950	Check for valid scores.
960-980	Check for *THREE OF A KIND*.
990-1000	Check for large or small straight.
1010-1170	Update the score.
1180-1190	Clear the screen.
1200-1220	Display data subroutine.
1230-1240	Clear the score card.
1250-1270	Update the score card.
1280-1320	Display final scores. Option to play again.
1330-1550	DATA statements.

```
100 REM **************
110 REM * CYBER-DICE *
120 REM **************
130 REM BY CURT GARCIA
140 REM 99'ER VERSION 2.3.1XB
150 REM
160 INPUT "DO YOU HAVE EXPANSION MEM.   (Y/N)?":EXP$
```

Continued on p. 33

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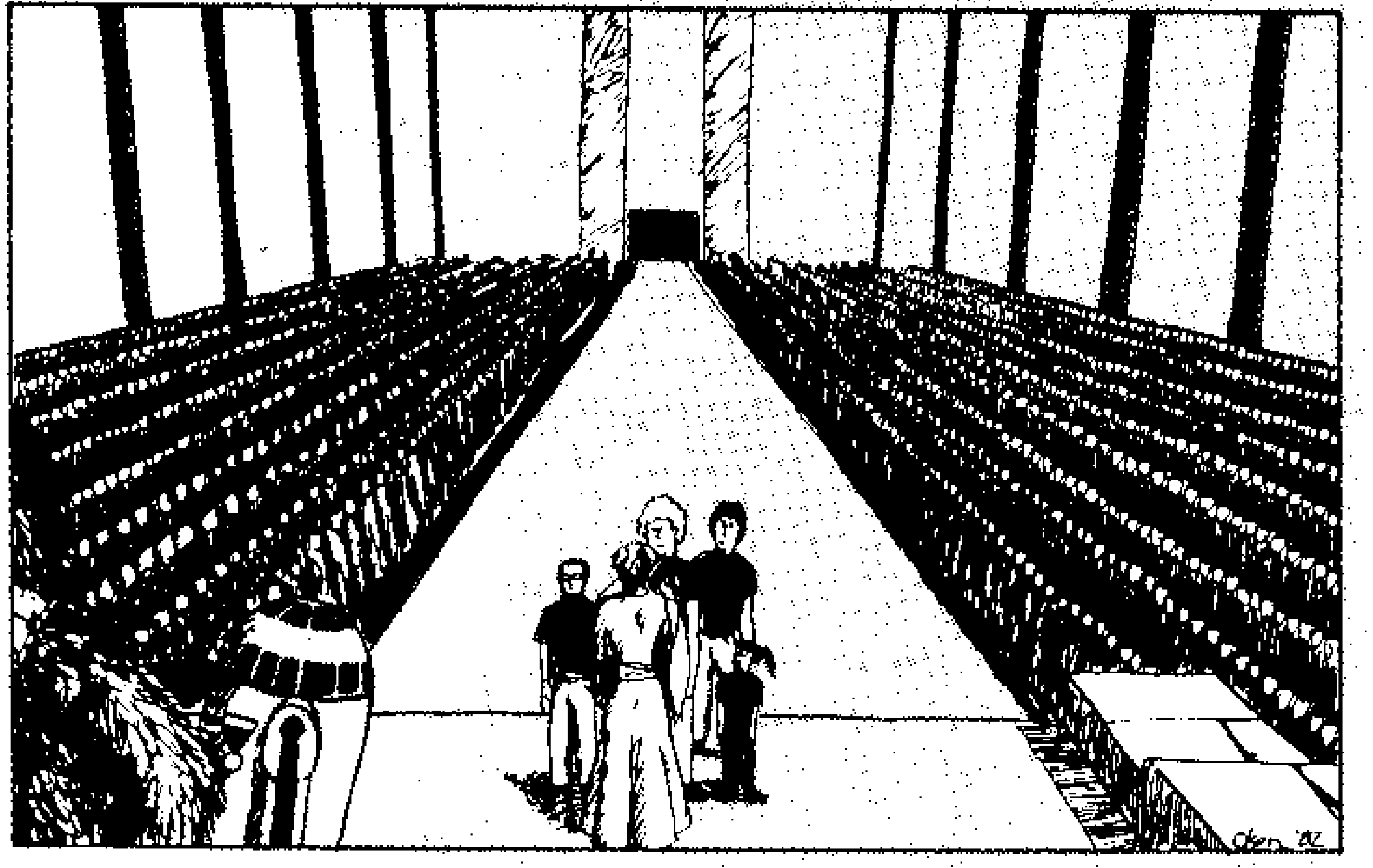

Name: Erik Davis (of Halifax, Nova Scotia, Canada)
Game: Munch Man
Score: 179,600

Name: Daryl Henry (of Sardis, British Columbia, Canada)
Game: Car Wars
Score: 21,060

Name: John Douglas (of West Seneca, NY)
Game: Parsec
Score: 349,500

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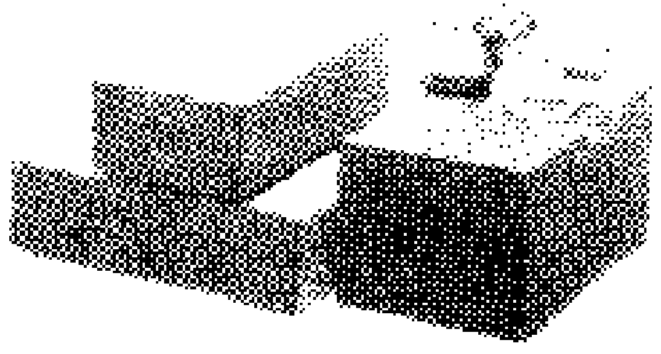

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Cyber-Dice...from p.31

```
170 IF EXP$="Y" THEN CALL INIT :: CALL LOAD(-31878,0
180 OPTION BASE 1
190 W=104 :: GOSUB 1190 :: RANDOMIZE :: DIM S(6,3,16
    ),GT(6),Q$(6),D(5),DV(6),Y5(6):: FOR I=1 TO 6 ::
     READ X,M$
200 CALL CHAR(X,M$):: NEXT I
210 FOR I=9 TO 13 :: READ A,B :: CALL COLOR(I,A,B)::
     NEXT I :: GOSUB 1200 :: GOSUB 1200
220 CALL SOUND(400,131,6,165,6,330,3)
230 CALL SOUND(400,196,6,262,6,330,4):: CALL SOUND(4
    00,147,5,370,4)
240 CALL SOUND(200,220,6,294,6,370,4):: CALL SOUND(2
    00,330;4)
250 CALL SOUND(400,196,6,370,4):: CALL SOUND(1600,24
    7,4,294,4,392,4):: GOSUB 1200
260 ACCEPT AT(12,26)VALIDATE("123456")SIZE(-1):Q5
270 FOR Y=16 TO 22 :: GOSUB 1210 :: NEXT Y :: ACCEPT
     AT(22,27)VALIDATE("123")SIZE(-1)BEEP:Z :: GOSUB
     1180
280 DISPLAY AT(1,6):"* CYBER DICE *"
290 FOR A=1 TO Q5 :: DISPLAY AT(3*A+2,1):"PLAYER";A;
    "NAME: "
300 ACCEPT AT(3*A+2,16)SIZE(-12)BEEP:Q$(A):: NEXT A
310 DISPLAY AT(24,4):"INSTRUCTIONS?(Y/N) N" :: ACCEP
    T AT(24,23)SIZE(-1)BEEP:M$
320 IF M$="N" THEN 340 ELSE GOSUB 1180
330 FOR Y=1 TO 24 :: GOSUB 1210 :: NEXT Y :: ACCEPT
    AT(24,26)BEEP:M$
340 ON ERROR 380 :: FOR A=1 TO Q5 :: Y5(A)=0 :: FOR
    G=1 TO Z :: FOR H=1 TO 16 :: S(A,G,H)=H<14
350 NEXT H :: NEXT G :: NEXT A :: CALL CLEAR
360 CALL SOUND(1000,1200,1)
370 FOR I=1 TO 1750 :: NEXT I :: GOTO 390
380 RETURN 390
390 RESTORE 1490 :: FOR Y=1 TO 20 :: GOSUB 1210 :: N
    EXT Y :: R=1 :: CALL HCHAR(19,3,42,29)
400 FOR A=1 TO Q5 :: GOSUB 650 :: CALL HCHAR(3,15,99
    ):: CALL HCHAR(20,17,32,15):: M$=Q$(A)
410 IF Q5>1 THEN GOSUB 1230
420 R1,G=0 :: H=1 :: FOR I=1 TO 4 :: CALL HCHAR(20,1
    7,32,15):: DISPLAY AT(20,17+INT(12-LEN(M$))/2)BE
    EP:M$
430 FOR B=1 TO 80 :: NEXT B :: NEXT I
```

Continued on p. 34

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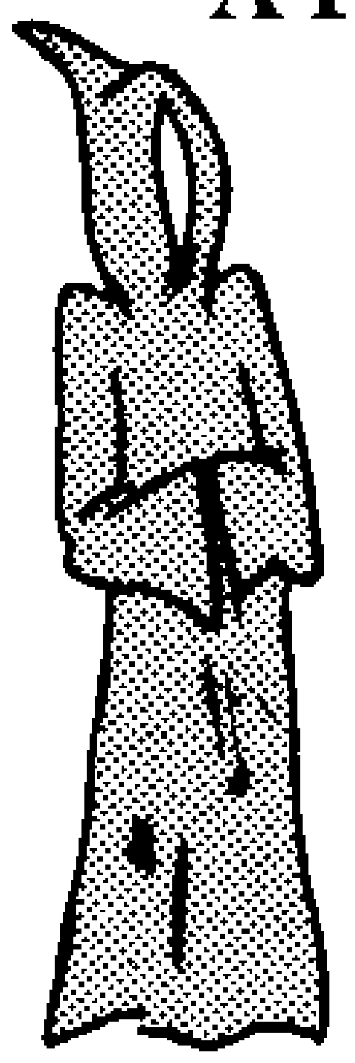

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Cyber-Dice...from p.33

```
440 R1=R1+1 :: DISPLAY AT(20,15)SIZE(1):STR$(R1):: F
    OR B=1 TO 4 :: IF DV(B)THEN 460 ELSE D(B)=INT(6*
    RND)+1
450 FOR I=-2 TO 0 :: CALL VCHAR(21,6*B+I,105,3):: NE
    XT I
460 NEXT B :: FOR B=1 TO 4 :: CALL SOUND(70,1400-B*1
    80,2):: ON D(B)GOSUB 500,530,490,520,480,510 ::
    NEXT B
470 IF L1=1 THEN 630 ELSE 540
480 CALL HCHAR(23,6*B,W):: CALL HCHAR(21,6*B-2,W)
490 CALL HCHAR(23,6*B-2,W):: CALL HCHAR(21,6*B,W)
500 CALL HCHAR(22,6*B-1,W):: RETURN
510 CALL HCHAR(22,6*B-2,W):: CALL HCHAR(22,6*B,W)
520 CALL HCHAR(21,6*B-2,W):: CALL HCHAR(23,6*B,W)
530 CALL HCHAR(23,6*B-2,W):: CALL HCHAR(21,6*B,W)::
    RETURN
540 CALL KEY(0,V,T):: IF T=0 THEN 540
550 IF (V=68)+(V=69)+(V=83)+(V=88)THEN E1=(V<70)*2+1
     :: GOTO 680 ELSE IF V=32 AND R1<3 THEN 440
560 IF V=13 AND G THEN 720
570 IF V<>82 THEN 610 :: CALL KEY(0,V3,T):: IF (T=0)
    +(V3<49)+(V3>54)THEN 560 ELSE V=V3-48
580 FOR B=1 TO 4
590 IF D(B)=V AND DV(B)THEN DV(B)=0 :: CALL HCHAR(24
    ,6*B-2,32,3):: CALL SOUND(99,330+90*B,2):: GOTO
    540
600 NEXT B
610 IF V=65 THEN SU=120 :: E=1 :: GOSUB 660 :: GOTO
    540
620 IF (V<48)+(V>54)THEN 540 ELSE V2=V-48 :: IF V2=0
     THEN GOSUB 660 ELSE L1=L1+1
630 FOR B=1 TO 4 :: IF D(B)=V2 AND DV(B)=0 THEN DV(B
    )=1 :: CALL SOUND(99,990,2):: CALL HCHAR(24,6*B-
    2,120,3)
640 NEXT B :: GOTO 540
650 FOR X=30 TO 15 STEP -5 :: CALL VCHAR(2,X+1,119,1
    7):: CALL VCHAR(2,X,119,17):: NEXT X
660 FOR B=1 TO 4 :: DV(B)=E :: CALL SOUND(99,330+99*
    B,2):: CALL HCHAR(24,6*B-2,SU,3)
670 NEXT B :: E,L1=0 :: SU=32 :: RETURN
680 CALL HCHAR(H+2,5*G+15,119)
690 IF (V=83)+(V=68)THEN 710 ELSE CALL HCHAR(H+2,15,
    119):: H=H+E1 :: IF (H=0)+(H=14)THEN H=ABS(H-13)
700 CALL HCHAR(H+2,15,128):: CALL HCHAR(H+2,15+5*G,9
    9):: CALL SOUND(90,220+90*H+150*G,2):: GOTO 540
```

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```
710 G=G-E1 :: IF G<Z+1 AND G>-1 THEN 700 ELSE G=ABS(
    G-Z)-1 :: GOTO 700
720 GT(A),T,E1,PT=0 :: IF YT=0 THEN 730 ELSE CALL HC
    HAR(24,3,32,28):: ON YT GOTO 920,950
730 FOR B=1 TO 6 :: DV(B)=0 :: NEXT B :: FOR B=1 TO
    4 :: DV(D(B))=DV(D(B))+1 :: NEXT B :: H1=H
740 FOR B=1 TO 6 :: IF DV(B)=4 THEN E1=50 :: H=8 ::
    GOTO 780
750 NEXT B :: IF S(A,G,H)>-1 THEN 540 :: IF H<7 THEN
     1010 :: ON H-6 GOTO 960,960,760,990,990,1030,98
    0
760 FOR B=1 TO 6 :: IF DV(B)=2 OR DV(B)=3 THEN E1=E1
    +DV(B):: IF E1=4 THEN 1080
770 NEXT B :: GOTO 1030
780 GOSUB 650 :: CALL HCHAR(10,15+5*G,99):: CALL HCH
    AR(10,15,128):: RESTORE 1550 :: C1$=RPT$(" ",28)
790 FOR B=1 TO 21 :: CALL SOUND(-90,200+40*B,3,990,4
    ,-4,0):: IF B<8 THEN READ C$ ELSE C$="  "
800 C1$=C$&C1$ :: C1$=SEG$(C1$,1,28):: DISPLAY AT(24
    ,1):C1$
810 CALL COLOR(10,2,7+(INT(B/3)=B/3)-10*(B=21))
820 NEXT B :: FOR B=Z TO 1 STEP -1 :: IF S(A,B,8)=-1
     THEN T=B :: GOTO 870
830 NEXT B :: FOR B=Z TO 1 STEP -1 :: IF S(A,B,E1/10
    )=-1 THEN T=D :: H=D(1):: GOTO 850
840 NEXT B :: GOTO 890
850 IF S(A,G,H)>-1 THEN G=T :: GOSUB 650 :: CALL HCH
    AR(H+2,15+5*G,99):: CALL HCHAR(H+2,15,128)
860 IF YS(A)<>Z THEN 980 ELSE S(A,G,16)=S(A,G,16)+10
    0*G :: GOTO 980
870 IF S(A,G,H)>-1 THEN G=T :: GOSUB 650 :: CALL HCH
    AR(10,15+5*G,99):: CALL HCHAR(10,15,128)
880 YS(A)=YS(A)+1 :: PT=50 :: IF YS(A)=1 THEN 1090 E
    LSE S(A,G,16)=S(A,G,16)+100*G :: GOTO 1090
890 FOR B=1 TO Z :: FOR F=7 TO 13 :: IF S(A,B,F)=-1
    THEN T=F :: GOTO 910
900 NEXT F :: NEXT B :: GOTO 940
910 DISPLAY AT(24,2)BEEP:"JOKER! LOC?(LOWER SECTION)
    " :: YT=1 :: GOTO 540
920 IF H<7 OR S(A,G,H)>-1 THEN 910 :: IF YS(A)=Z THE
    N S(A,G,16)=S(A,G,16)+100*G
930 ON H-6 GOTO 980,980,1080,1070,1060,1030,980
940 DISPLAY AT(24,2)BEEP:"MUST SCORE 0 (TOP SECTION)
    " :: YT=2 :: GOTO 540
950 IF S(A,G,H)>-1 THEN 940 ELSE 1090
960 FOR B=1 TO 6 :: IF DV(B)>H-5 THEN 980
```

Continued on p. 58

STAR COMMAND

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Simon Kind...from p.31

```
100 REM ****************************
110 REM * CLOSE ENCOUNTERS OF THE *
120 REM *         SIMON KIND       *
130 REM ****************************
140 REM BY GARRETT MINEO
150 REM 99'ER VERSION 2.3.1
160 REM
170 REM
180 GOTO 250
190 READ X,Y,M$
200 FOR I=1 TO LEN(M$)
210 V=ASC(SEG$(M$,I,1))
220 CALL HCHAR(Y,X+I,V)
230 NEXT I
240 RETURN
250 CALL SCREEN(2)
260 CALL CLEAR
270 RANDOMIZE
280 DATA 33,8,34,00000008,35,000001
    ,36,0004,38,0002,74,7FC08080800C
    07F00
290 DATA 88,7FC080FF80C07F00,90,7E4
    0403C02027E00,37,0,81,424448506
    84442
300 FOR X=1 TO 10
310 READ A,B$
320 CALL CHAR(A,B$)
330 NEXT X
340 CALL COLOR(1,16,1)
350 FOR ST=5 TO 8
360 CALL COLOR(ST,16,1)
370 NEXT ST
380 DATA 9,10,JLOSE XNCOUNTERS,13,1
    2,OF  THE,11,14,ZIMON  QIND,6,2
    2,PRESS ANY KEY TO BEGIN
390 DATA 5,24,FOR INSTRUCTIONS PRES
    S I
400 FOR W=1 TO 5
410 GOSUB 190
420 NEXT W
430 R=INT(RND*24+1)
440 C=INT(RND*32+1)
450 Z=INT(RND*6+33)
460 CALL KEY(0,K,S)
470 CALL GCHAR(R,C.W)
480 IF W>64 THEN 430
490 CALL HCHAR(R,C,Z)
500 IF S=0 THEN 430
510 CALL CLEAR
520 IF K=73 THEN 530 ELSE 700
530 CALL SCREEN(5)
540 FOR X=2 TO 4
550 CALL COLOR(X,16,1)
560 NEXT X
570 U=1
580 CALL HCHAR(1,1,42,32)
590 CALL VCHAR(1,32,42,24)
600 CALL VCHAR(1,1,42,24)
610 CALL HCHAR(24,1,42,32)
620 DATA 3,2,SPECIAL PROGRAM COMMAN
    DS,5,4,1) REPEAT NOTES,5,6,2) E
    RASE ENTRY,5,8,3) PLAY 50 NOTES
630 DATA 5,10,4) HIGH SPEED,5,12,5)
     NO COLORS,5,14,0) END GAME,5,1
    7,B=BLUE      Y=YELLOW
640 DATA 3,19,R=RED  W=WHITE  G=GRE
    EN,8,22,-PRESS ANY KEY-
650 FOR W=1 TO 10
660 GOSUB 190
670 NEXT W
680 CALL KEY(0,K,S)
690 IF S=0 THEN 680
700 IF U=1 THEN 750 ELSE 710
710 FOR I=1 TO 50
720 READ F$
730 IF F$="-PRESS ANY KEY-" THEN 750
740 NEXT I
750 CALL CLEAR
760 DATA 00FE8282828282FE,003010101
    0101038,00FE020202FE80FE,00FE02
    023E0202FE,008282828282FE0202
770 DATA 00FE808080FE02FE,00FE8080F
    E8282FE,00FE020202020202,00FE82
    82FE8282FE,00FE8282FE0202FE,0,FF
780 DATA 00000000000000FF,010101010
    1010101,8080808080808080,008282
    82FE828282,80C0E0F0F8FCFEFF,010
    3070F1F3F7FFF
790 FOR X=48 TO 65
800 READ A$
810 CALL CHAR(X,A$)
820 NEXT X
830 DATA 18183C3C7E7EFFFF,01030F7FF
    FFFFFFF,80C0F0FEFFFFFFFF,181818
    1818181818,FFFFC3C3C3C3FFFF,000
    00000FFFFFFFF
840 DATA 000000000030F3FFF,00000000C
    0F0FCFF,FF3F0F03,FF7F3F1F0F0703
    01,FFFEFCFBF0E0C08,FFFCF0C,FFFF
    FFFF
850 DATA 0103070F1F3F7FFF,80C0E0F0F
    8FCFEFF,FFFFFFFFFFFFFFFF,183C7E
    7E3C18
860 FOR X=72 TO 88
870 READ A$
880 CALL CHAR(X,A$)
890 NEXT X
900 DATA FFFFFFFFFFFFFFFF,103038383
    C7C7EFF,00000000000087EFF,004038
    7C3C181091,00000000000011BB,000
    010183830C7D13
910 DATA 0000000000048ED,0,FFFFFFF
    FFFFFFFFF
920 FOR X=120 TO 128
930 READ A$
940 CALL CHAR(X,A$)
950 NEXT X
960 DATA 40,FFFFFFFFFFFFFFFF,96,000
    000C,97,0000001818,98,000000030
    3,104,FFFFFFFFFFFFFFFF,105,C060
    30180C060301
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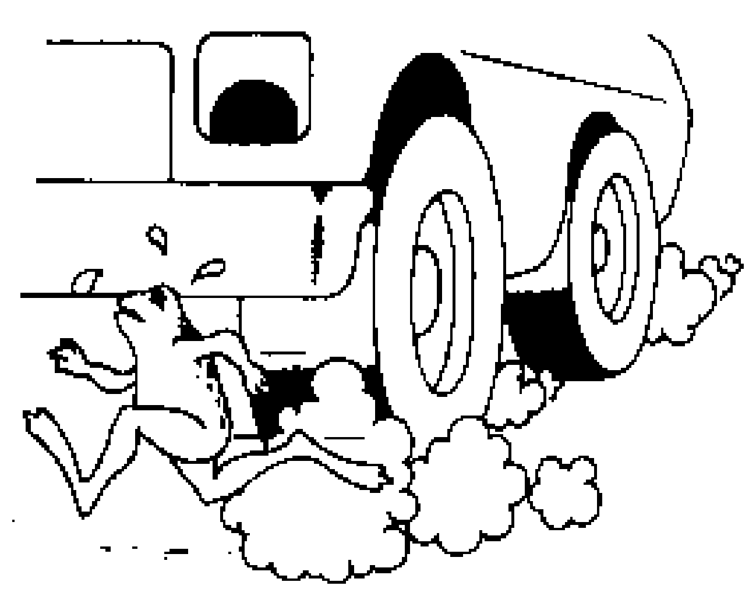
```
970 DATA 112,FFFFFFFFFFFFFFFF,136,F
    FFFFFFFFFFFFFFF,137,1,138,81422
    4193D3D19FF,139,814224183C3C18F
    F,140
980 DATA BCBCBCBC24242466,141,BDBDB
    DBD24242466,144,FFFFE7E7E7E7FFF
    F,152,00FE8080FE0202FE,153,00FE
    808080808OFE
990 DATA 155,00FE8282FE888482,156,0
    0FE8080F88080FE,157,0000FF,158,
    0038101010101038,159,00FC848080
    8C84FC
1000 FOR X=1 TO 21
1010 READ Z,A$
1020 CALL CHAR(Z,A$)
1030 NEXT X
1040 DATA 4,4,2,4,2,4,6,2,2,2,2,2,2
     ,2,7,2,7,1,12,1,13,1,5,1,16,1,
     5,2,2,4
1050 FOR X=2 TO 16
1060 READ A,B
1070 CALL COLOR(X,A,B)
1080 NEXT X
1090 CALL SCREEN(2)
1100 DATA 22,1,40,96,20,2,144,2,21,
     2,144,3,7,13,77,2,7,16,87,3,7,
     20,77,2,8,9,76,17,9,8,87,19
1110 DATA 10,8,87,19,11,11,87,13,12
     ,12,84,11,12,15,87,5,13,15,76,
     5
1120 FOR X=1 TO 13
1130 READ A,B,C,D
1140 CALL HCHAR(A,B,C,D)
1150 NEXT X
1160 DATA 19,2,65,19,3,64,16,7,137,
     7,28,137,18,27,137,14,25,137
1170 DATA 5,3,137,7,4,137,5,7,137,7
     ,7,137,4,10,137,3,12,137,4,15,
     137,14,7,137,15,27,137
1180 DATA 12,5,137,16,1,137,17,16,1
     37,2,32,137,10,31,137,17,20,13
     7,18,30,137
1190 DATA 3,27,137,4,21,137,6,27,13
     7,17,12,137,4,17,75,5,17,72,6,
     16,85
1200 DATA 6,17,87,6,18,86,7,12,78,7
     ,15,73,7,19,74,7,22,79,8,8,85,
     8,26,86
1210 DATA 9,7,85,9,27,86,10,7,81,10
     ,27,82,12,11,80,12,23,83,17,17
     ,88
1220 FOR X=1 TO 44
1230 READ A,B,C
1240 CALL HCHAR(A,B,C)
1250 NEXT X
1260 FOR X=1 TO 50
1270 TR=INT(RND*6+121)
1280 C=INT(RND*32+1)
1290 CALL GCHAR(21,C,OC)
1300 IF OC<>32 THEN 1320 ELSE 1310
1310 CALL HCHAR(21,C,TR)
1320 NEXT X
1330 CALL VCHAR(14,15,75,3)
1340 CALL VCHAR(14,17,75,3)
1350 CALL VCHAR(14,19,75,3)
1360 CALL KEY(0,K,S)
1370 IF S<>0 THEN 1410
1380 GOSUB 1710
1390 FOR D=1 TO 50
1400 NEXT D
1410 CALL COLOR(15,5,11)
1420 FOR D=1 TO 200
1430 NEXT D
1440 FOR D=1500 TO 800 STEP -10
1450 CALL SOUND(-200,D,2,D+1,2,D+2,
     2,-4,1)
1460 NEXT D
1470 FOR V=1 TO 30
1480 CALL SOUND(-100,800,V,801,V,80
     2,V,-4,V)
1490 NEXT V
1500 CALL COLOR(6,8,2)
1510 CALL COLOR(7,8,2)
1520 CALL COLOR(8,5,2)
1530 FOR D=1 TO 250
1540 NEXT D
1550 CALL SOUND(550,523,0,524,0)
1560 CALL VCHAR(10,21,136,2)
1570 CALL SOUND(500,587,0,588,0)
1580 CALL VCHAR(10,13,104,2)
1590 CALL SOUND(500,466,0,467,0)
1600 CALL VCHAR(10,17,120,2)
1610 CALL SOUND(500,233,0,234,0)
1620 CALL VCHAR(10,15,112,2)
1630 CALL SOUND(10,40000,30)
1640 CALL VCHAR(10,19,128,2)
1650 FOR X=0 TO 30
1660 CALL SOUND(-500,349,X,350,X)
1670 NEXT X
1680 GOSUB 4260
1690 CALL HCHAR(23,8,58,2)
1700 GOTO 1810
1710 FOR X=1 TO 32
1720 FOR C=96 TO 98
1730 IF X=1 THEN 1760
1740 CALL SOUND(-100,2000,25)
1750 CALL HCHAR(1,1,32,32)
1760 CALL HCHAR(1,X,C)
1770 NEXT C
1780 NEXT X
1790 CALL HCHAR(1,1,32,32)
1800 RETURN
1810 CALL HCHAR(23,2,152)
1820 CALL HCHAR(23,3,153)
1830 CALL HCHAR(23,4,48)
1840 CALL HCHAR(23,5,155)
1850 CALL HCHAR(23,6,156)
1860 CALL HCHAR(24,2,157,8)
1870 CALL HCHAR(22,13,60,9)
1880 CALL HCHAR(24,13,59,9)
1890 CALL HCHAR(23,12,61)
1900 CALL HCHAR(23,22,62)
1910 CALL HCHAR(24,25,157,8)
```

Continued on p. 62



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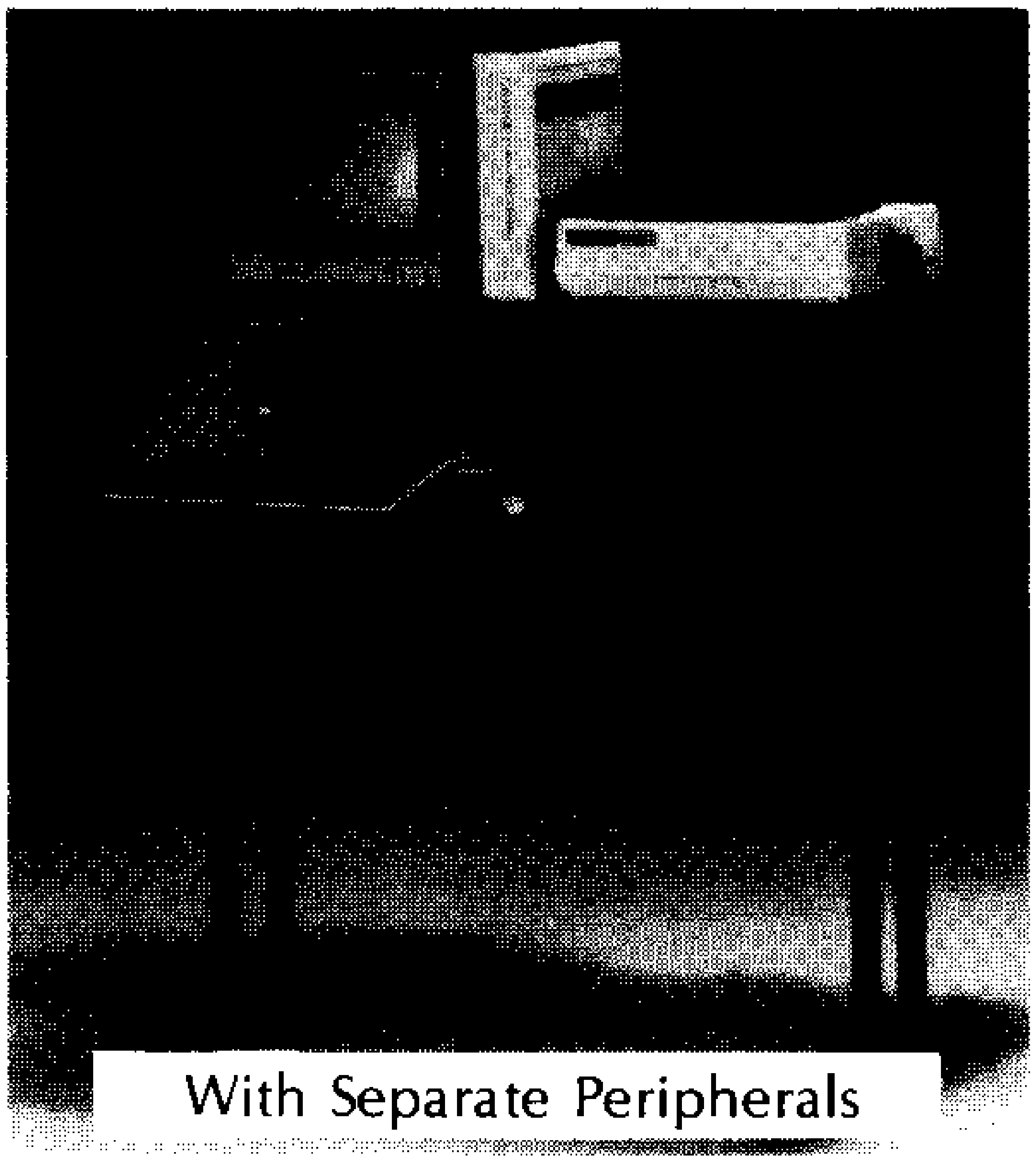

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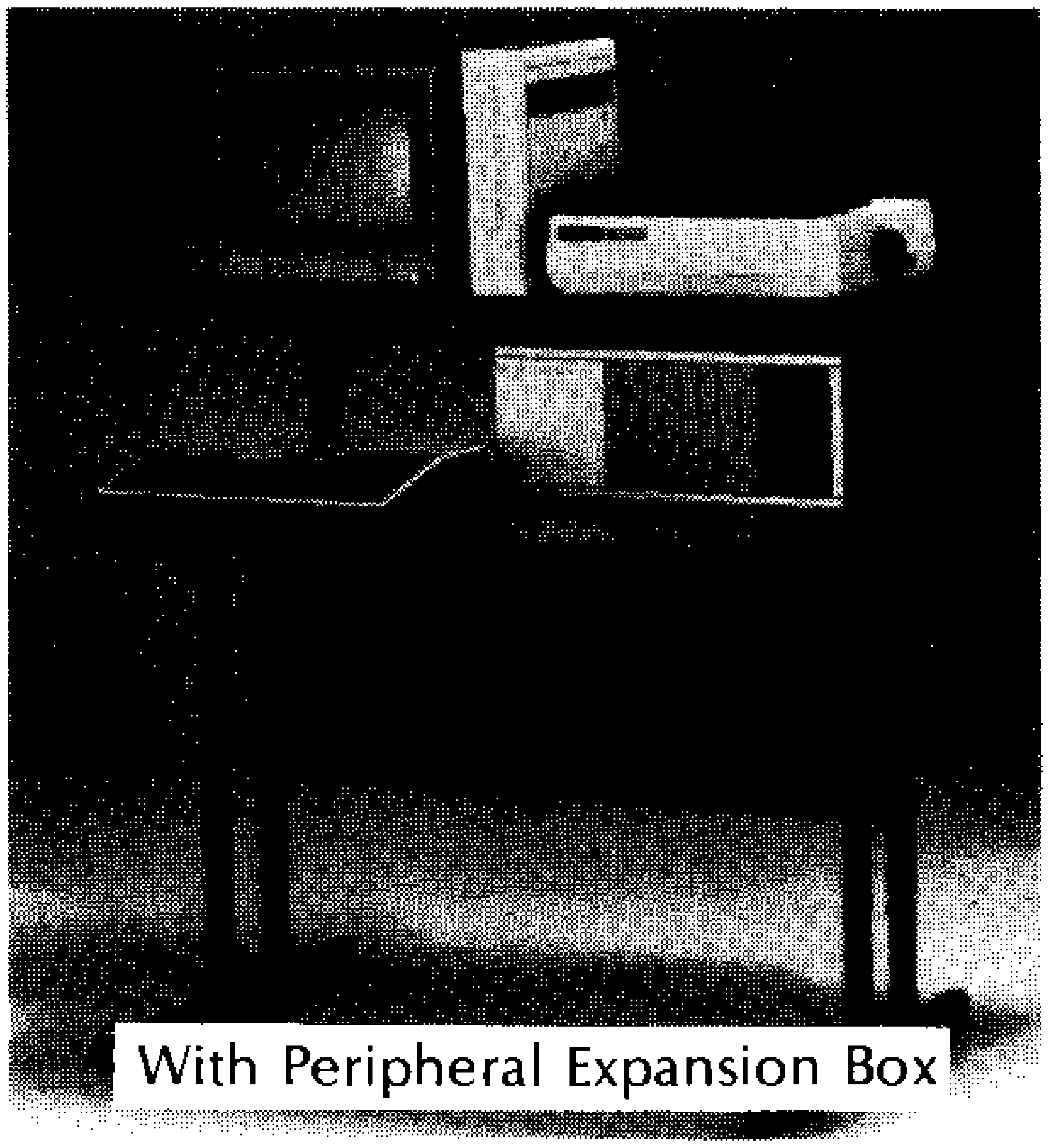

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Spotlight. . . from p.27

toehold for learning and improving skill in the game.

GMK: *How well do you do when actually playing your own game?*

JD: Well, like I said earlier, I get more enjoyment from programming than actually playing the games. Because of this, I really haven't tried to get high scores. In *Car Wars* my top score is about 33,000; *Munch Man* is about 122,000; and *Parsec*, about 77,000. So I haven't even broken 100,000 on *Parsec* yet! They're good scores, but not even close to the top scores. One of the problems is that we have a debugger here, and I can easily cheat my way through the games. And you get so used to boosting yourself up to the higher levels. . .you've already been there, and it's so easy to do that you don't really want to take the time to get there legitimately.

GMK: *Can you give us a little background on how* Parsec *evolved?*

JD: We started *Parsec* in the middle of February and completed it in the middle of July, so that was five months. But that was with two of us working on it. Paul Urbanus, my partner, was a summer student here; he worked on *Parsec* for two months. The game therefore really took a total of seven man-months to complete. Paul certainly did help tremendously in getting it done; he wrote several of the major subroutines such as the speech interrupt-driven part of it, and helped speed up the scroll subroutine. Paul also modified the line-drawing subroutines that he had already been through [the LINES demonstration program that comes with Mini Memory—Ed.] for use with *Parsec.*

GMK: *What was the major technical problem you had to overcome?*

JD: Well that would have to be the scrolling routine. There was heavy access of VDP RAM. And any time you do that, you run the real risk of slowing the whole thing down tremendously. Paul used the trick of loading some of the program code into the fast CPU RAM on the 16-bit bus. This gave us about a 20% boost in speed of the scroll routine.

GMK: *We understand that* Parsec *is the first TI game to be released that used the high-resolution graphics mode of the video processor chip in the TI-99/4A. Can you tell us something about how sprites work in this mode?*

JD: The problem with using the high-resolution graphics mode is not only being unfamiliar with it, but also understanding the constraints. First, it uses up so much of the VDP RAM that there's only 2,000 bytes of RAM free for the programmer to use. Also, at the time, we felt we could not use sprite automotion in this mode. The problem we had was that the scroll used up so much processor time that in order for me to move sprites on the screen, I *had* to use automotion. If I were to move the sprites pixel by pixel as I did in *Munch Man* and *Car Wars*, it would be way too slow. I *had* to go to automotion or else the project would have been killed.

At this point, Paul remembered that the 99/4A's newer architecture would allow us to do our own interrupt processing; this meant that we *could* do our own sprite automotion if we relocated the sprite attribute table from where it normally was to the unused area of high-VDP RAM that I mentioned earlier.

GMK: *Where did the idea for the tumbling asteroids come from?*

JD: Paul Urbanus actually developed the different patterns in LOGO to get the tumbling effect. It was very easy to see the animation, and change the shapes accordingly. Then, it was a simple thing for me to just load the data for the different shapes into my program, change the coincidence a little bit, and away it went. . .

GMK: *It appears that the speech doesn't slow down the play of the game at all. . .it comes through as being a simultaneous process. How did you achieve this breakthrough?*

JD: Well, because we were already using our own interrupt processing for the sprite automotion, it made sense to also try interrupt-driven speech. This worked out extremely well; there was apparently no slowdown problem at all—even though there was 200 bytes of logic in the speech interrupt routine that had to be processed 60 times a second.

GMK: *How did speech fit into the overall game design?*

JD: The idea behind the speech was to have a female onboard computer warning you of things that are coming—like when fuel is low and a fueling tunnel is up ahead, or that there's an attack on its way. So speech can be important in that it gives you some signals of what's coming up so you don't have to read the written messages at the bottom of the screen. You can still play the game without the speech; it was important, however, to make sure that speech wasn't totally integral to playing the game, because if someone doesn't have a Speech Synthesizer they would be out of luck.

GMK: *What were the reasons for simulating a female voice?*

JD: We wanted something different from the basic Speech Synthesizer's voice, and also we were intrigued by the TV shows and movies that used a female voice as a spaceship's onboard computer. It seems to have a sort of mystical effect. Also, somebody told us that you *couldn't* digitize female speech because of things like high-frequency patterns. So, we just had to go off and *do* it. . .

GMK: *What are some of the obstacles in producing games for the Home Computer at this point in time?*

JD: The limitation is that you are working with an under-$200 computer with certain hardware architecture limitations that are built in. The only way to possibly overcome some of them is with software tricks. It's hard to create the tension and excitement of some of the commercial coin-op $3,800 arcade games—hard to compete with their special screens designed for each specific game, and hard to compete with their fancy remote controls.

GMK: *Do you feel that with* Parsec *you've just scratched the surface in what this machine can do, or have you already pushed the machine to its limits?*

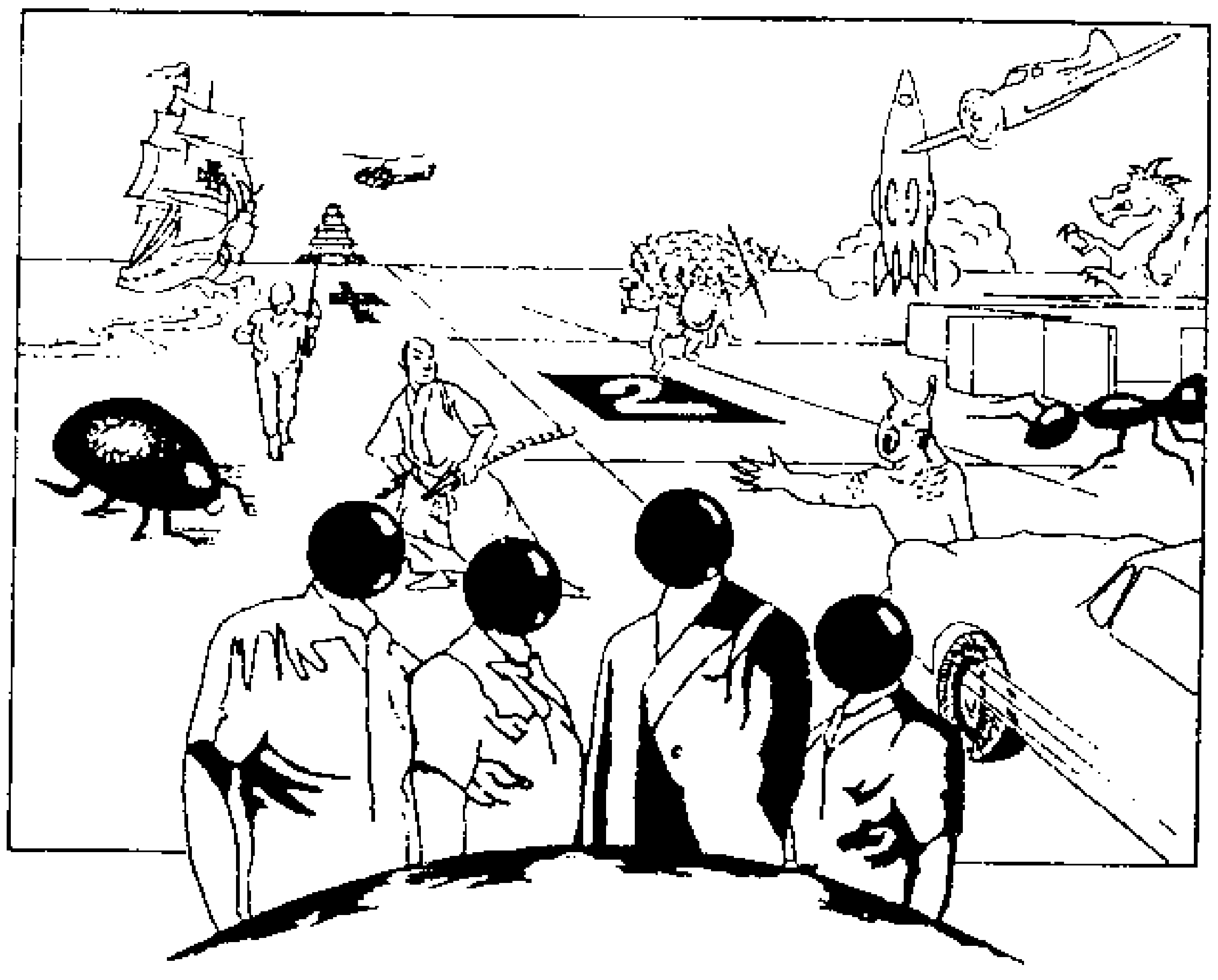
JD: Well no—I think with *Parsec* it was just the *beginning*. With the other games, I was becoming familiar with what *I* could do; but with *Parsec*, I'm now getting a feel for what the *machine* can do. It's a kind of launching and testing of some of the good points of the machine, and taking advantage of some of the speed of 9900 code. There are many other things that are really still out there that we would like to explore and exercise.

GMK: *So what you're saying is that the best is yet to come. . . We can expect whole new generations of sophisticated games coming from TI.*

JD: Definitely. Because of the speed of the 16-bit 9900 processor, many exciting things are possible. To give you an example of its high speed, in *Munch Man* we had to put a substantial delay in between each pixel movement of the monsters and your Man—not counting the almost 4K-bytes of ROM code that must also execute in that period. If that delay was taken out, those monsters and your *Munch Man* would move around the screen so fast that they would look like they were *twenty* instead of four or five! This will give you some idea of just how incredibly fast the 9900 processor is.

GMK: *What strategy and tips can you give to players of your games?*

JD: Definitely memorize patterns in *Car Wars* to get through on higher levels. In *Munch Man*, you have to pay close attention to the energy levels. On the higher screens, 15 and above, you have to make sure the chain gets completely laid down in one area before moving on. In *Parsec*, the big factor is getting used to *flying* the craft instead of just laying on the fire button. Get used to moving the craft up and down, and changing the vertical lift speed at the appropriate time. Becoming a good shot, where you can hit a craft within one or two bursts, is a big factor in getting through the attack waves and making it over to the higher levels. If you can do this, you're well on you way to becoming immortalized in the 99'er Hall of Fame.



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over and over
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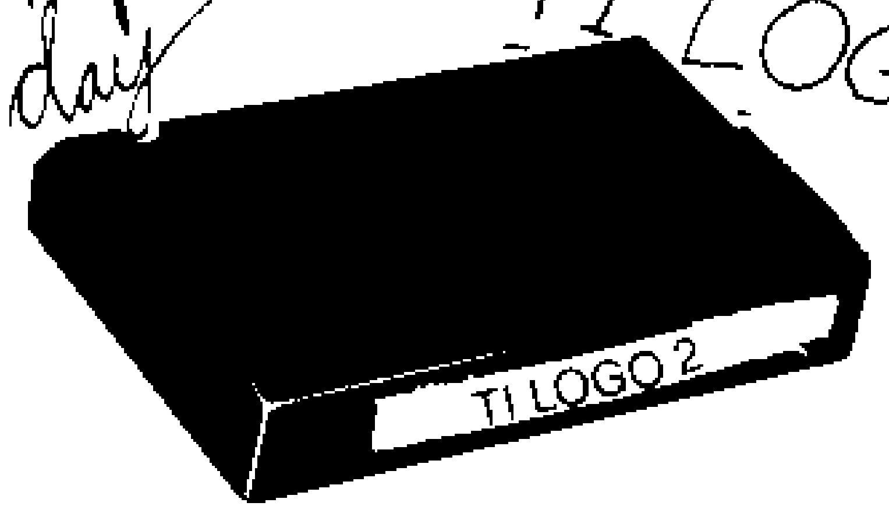

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- ability to address a printer through an RS 232 interface.

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LOGO TIMES

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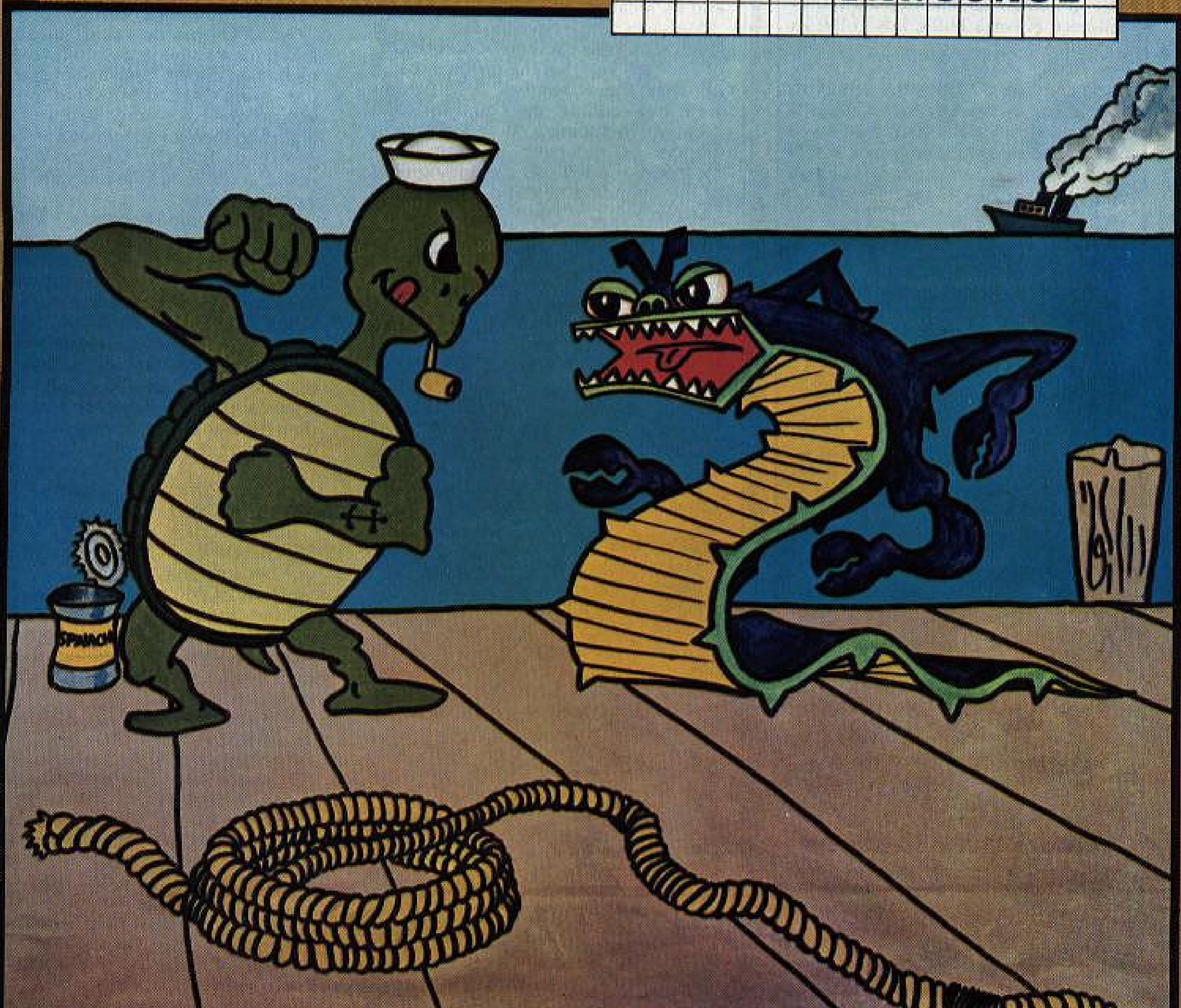
THE MAGAZINE OF THE LOGO LANGUAGE



Introduction

LOGO Times is an information resource for anyone interested in participating in the creation of their own *personal* language – one that will easily allow them to communicate with a computer in a totally new audiovisual realm of applied imagination, exploration, and self-discovery. The articles on these pages concern the use of the new TI LOGO language, but readers, however, do *not* need any additional software or equipment (or even a computer) to understand and learn from the material presented here.

If readers want to actually *experience* a TI LOGO environment, they will need either a TI-99/4 or TI-99/4A computer, the Expansion Memory peripheral, and the TI LOGO Command Module. A disk drive, although convenient to have, is *not* required; a user's work may alternately be saved on cassette tape, printed out on the TI Thermal Printer, or hand copied into a notebook (for later re-keyboarding).

In each issue, one or more of the articles may reference or build upon the topics discussed in a previous article. It is therefore recommended that for maximum benefit and understanding, new readers obtain the appropriate back issues of *99'er Magazine* in which the *LOGO Times* articles are contained.

Notice

LOGO Times is actively soliciting articles. Manuscripts should be typed double-spaced, and accompanied by a cassette tape or disk if containing any lengthy procedures or graphics.

Send all materials to:

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99'er Magazine
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All mail directed to the Letters-to-the Editor column (*Letters on LOGO*) will be published in accordance with the conditions set forth on *99'er Magazine's* Masthead page.

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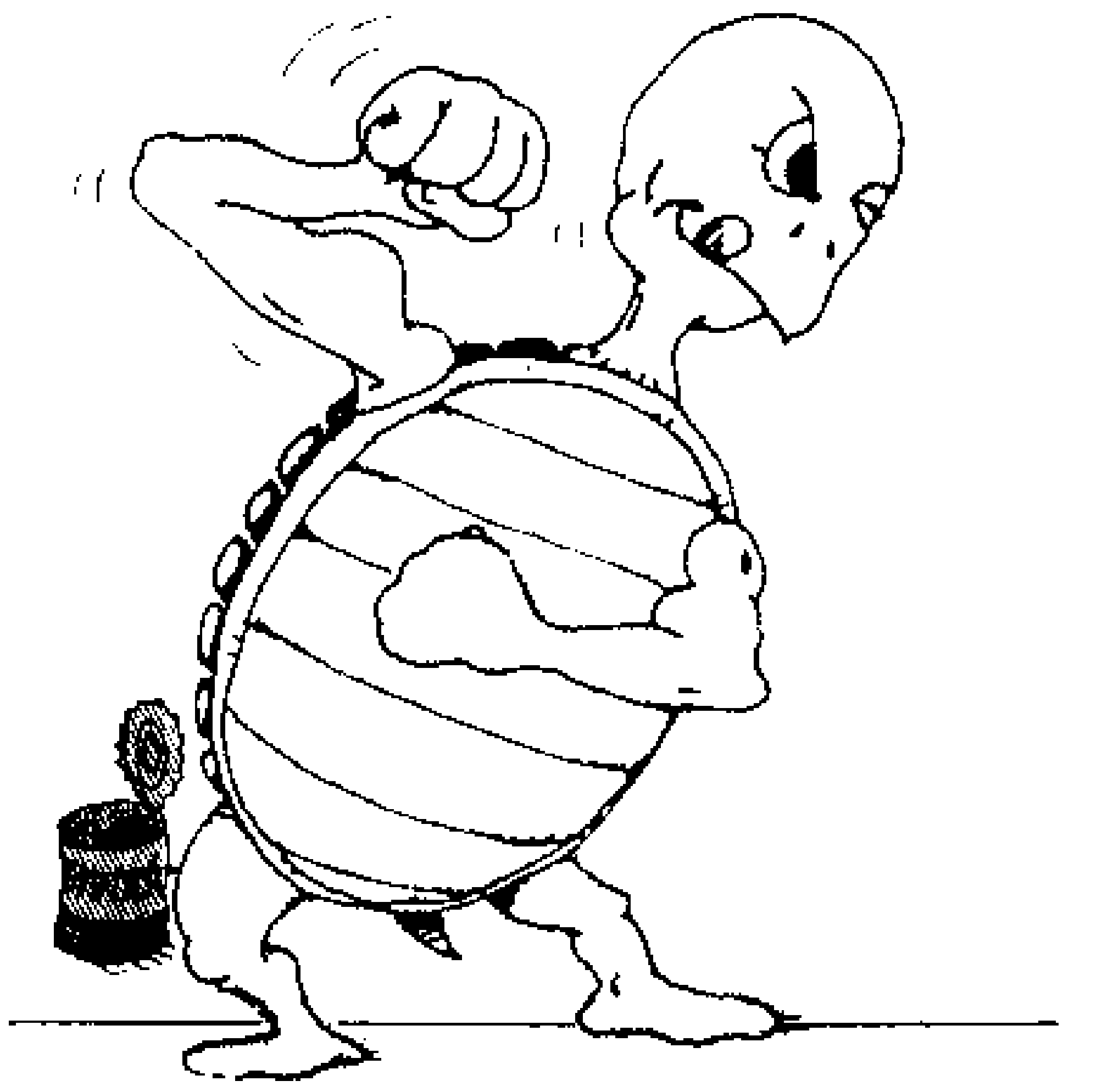

It's a rare beast—the computer program that runs as intended the first time it's typed in. More likely, the program is plagued with "bugs"—and removing them can be arduous work.

Debugging in TI LOGO is simpler than in some other languages, if you use a well-planned system of bug-hunting techniques. Once you set down a workable plan of attack, the extermination process can become enjoyable. In fact, some people start enjoying the hunt as much as having the bug-free program!

Read and Interpret

In some languages, the computer prints out a "dump" or an error number, perhaps with a cryptic note attached (e.g., "endcard encountered no data found"). LOGO uses a few standard messages showing the type of problem and its location.

Messages which have the tags " . . . at level <number1> line <number2> of . . ." tell you that the problem came up after the <number1> programs were run—adding one count for each program, including a count for each iteration or recursive program. The messages also tell you the line number of the offending bug and its program. Usually, you can find the bad line and make the change.

When the first portion of the message is "Tell me how to . . .", this means that you have typed a program name, without writing the program. Often, that message comes of a spelling or typing error, such as FD40 or FORWARD 40.

The message "TO doesn't like <XXX> as input" indicates that you have chosen an illegal name for a program. LOGO will not let you name programs with LOGO primitives (to avoid any ambiguity). Nor for the same reason, can you name programs with numbers.

Out of Ink

The message "out of ink" means that a program has exhausted all of the tiles allotted to the turtle (the turtle may use tiles 0-31 and 96-255 for drawing).

"Out of space at level <number1> line <number2> of XXX" means that a program has used up the computer's free memory. To help avoid this limitation, programs should be written more efficiently and have their blank lines removed. And they can be run when few or no other programs are in the workspace.

"Out of space" is a last gasp: all memory has been exhausted. In the original version of TI LOGO this message means you can do nothing but shut off the machine and lose any work you haven't already saved. The new version of TI LOGO will feature a warning that comes on before all the memory is used up. You can then erase any unneeded programs, shorten existing programs, or save your work—thus preventing a system lock-up.

<XXX> Has No Value

"<XXX> has no value" means yo asked for a value (e.g., :stuff) when th name had not yet been assigned a valu (i.e., using CALL or MAKE) or the valu was assigned as part of the title of a program and then asked for outside the program (e.g., TO POLY :S :A has values fo both S and A inside the program, but no external to it).

"<XXX> didn't output" indicate that either a primitive or a program wa used as input to a second primitive o program, but the input did not produ a number or text as required. If you typ SETHEADING FORWARD 40, the cu rent sprite or turtle will move forwa 40, and then the computer will compla that the FORWARD didn't output. Th is because, SETHEADING requires numerical input (or a value equivale to a number). The computer runs th command FORWARD 40 with the expectation that the command wil somehow generate a number.

Both SETHEADING RANDOM and SETHEADING COLOR are quite proper, because each yields a number Similarly, if you type FIRST FORWAR 40, the current sprite or turtle advance 40 and then the computer complain that FORWARD didn't output. This happens because FIRST is expecting a wor or list as input.

Tell Me More

The message "Tell me more" mean that a necessary input was left off a command or operation.

Some esoteric bugs produce th message "<XXX> was given instead o 'TRUE' or 'FALSE' " or "Tell me wha to do with <XXX> at leve <number1> line <number2> o <ZZZ>." The former message i generated by supplying improper inputs to TEST, such as:

```
TEST 4 + 5
```

which yields "9 was given instead o 'TRUE' or 'FALSE'." Where:

```
TEST 4 + 5 = 10
```

in LOGO

By Henry Gorman, Jr.
Contributing Editor

is acceptable. The statement

4 + 5 = 10

yields "Tell me what to do with 'FALSE'". The "Tell me what to do with . . ." message appears anytime the computer has a number or some text without explicit instructions for it. Most often, the message appears in print situations such as:

PRINT 4 + 5 = 10

produces a printed "FALSE."

Other times, "Tell me what to do with <XXX>" appears in recursive operations. The first four years I programmed in LOGO, I would attempt to write recursive operations thus:

```
TO FACTORIAL :N
IF :N = 0 OUTPUT 1
:N * FACTORIAL :N - 1
END
```

But when I ran the program, I always received the "Tell me what to do with . . ." message until I corrected the program to:

```
TO FACTORIAL :N
IF :N = 0 OUTPUT 1
OUTPUT :N * FACTORIAL :N - 1
END
```

The computer has to be told what to do with 1 times 1 at the second line of the program.

A New Bug

Last summer, my students ran into a bug that was new to me. They were copying a program and accidentally erased the END of the program just before returning to command mode (FUNCTION BACK). The computer did not fully return because of this bug, and since the program was not yet defined (beginning with TO and ending with END), the computer assumed that each additional line typed in was still part of the program. Just as when the computer is in full edit mode, none of the typed lines were executed. However, by supplying a cursor instead of the normal flashing, the computer showed that it was not in command mode. To correct this bug and get to full command mode, type END and press enter. Then the extraneous lines in the program can be removed through normal EDITing.

A second debugging tactic: Make sure that the limitations of the computer aren't exceeded.

I frequently forget that more than four sprites on any given horizontal line will cause the four with the lowest number to show, even if they have no shape or are colored clear.

Although the memory expansion gives you a fair supply of working memory, it is possible to exceed that limit and receive the "out of space" message. There is no explicit warning beforehand, but there are some clues—for instance, when it takes a very long time to move from edit mode to command mode, or when the response time of the computer running a program becomes very long. When you think you may be near the limit, it is wise to clean up your workspace and save your programs on tape or disk.

Periodically saving your work is a good computer-user habit, since it minimizes your losses to the "out of space" bug and also protects you from random crashes caused by voltage spikes or drops. These fluctuations in voltage can occur whenever motors drawing heavy current (such as air conditioner compressors) are shut off or come on—even if the motors are in someone else's house.

The Pause Feature

There is not a separate PAUSE command in TI LOGO, however the FUNCTION 7 of the 99/4A and CONTROL G of the 99/4 do the same thing. When a program runs but is still bugged by undesired results, you can often use the Pause feature to find the problem. Do it by starting the program and then pressing the appropriate function keys. The computer returns the message "Paused at level <number1> line <number2> of <XXX>," which tells you how many times the program has run (level) and what line is about to be executed. Ordinarily, if you make a typographical error or enter a line which would result in an error message while paused, the computer will exit from pause and return to command mode. However, if you type DEBUG, the computer will not automatically exit from pause because of an error message. To remove this debugging feature, type DEBUG a second time.

If the program has either local variables (with a value only when the program is being run) or global variables (with a value interior and exterior to the program), these can be observed when paused by merely typing PRINT <variable name>. For some programs, the variable value can tell you what has happened (or what has failed to happen) in the program. For graphics programs,

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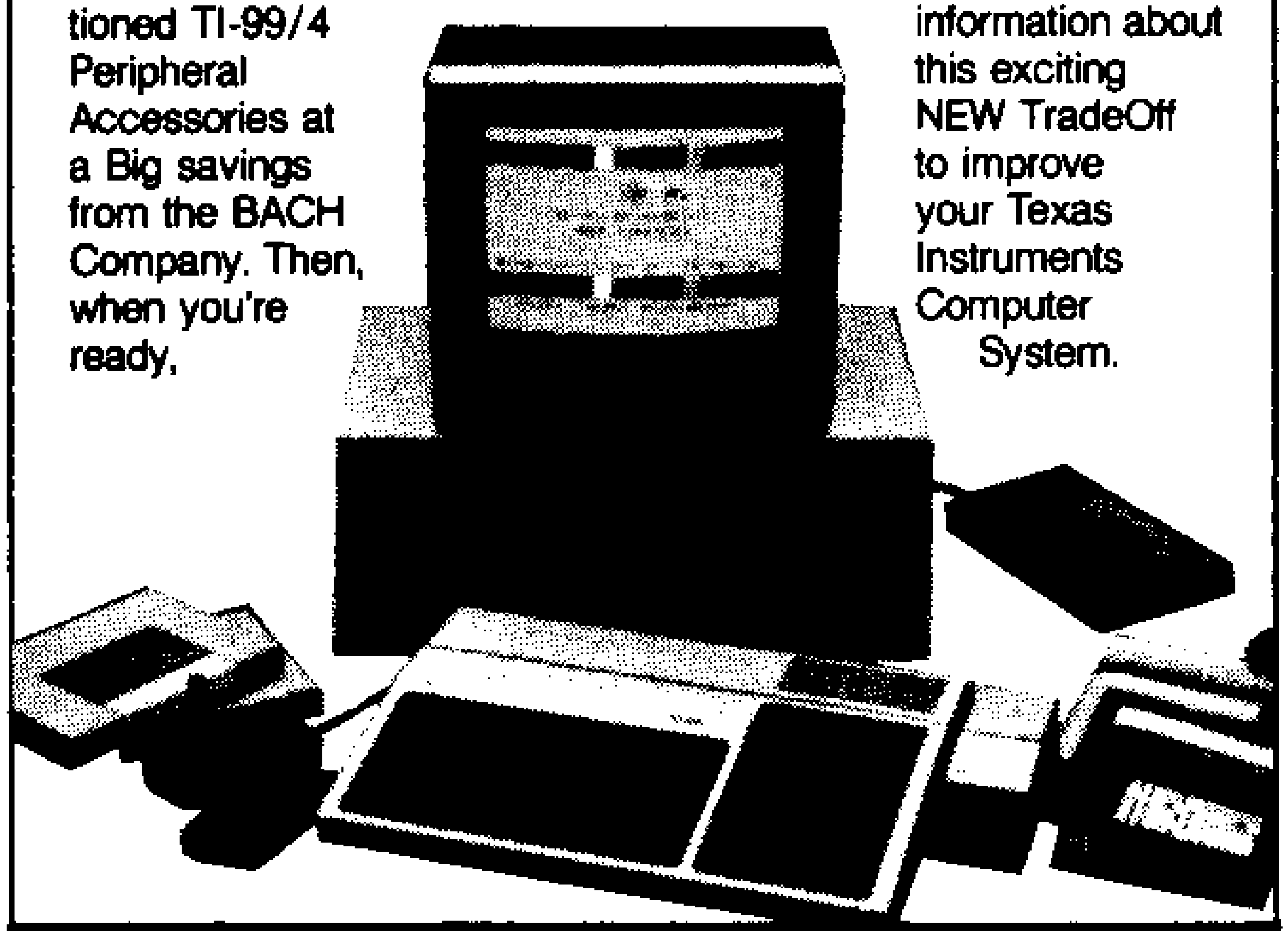

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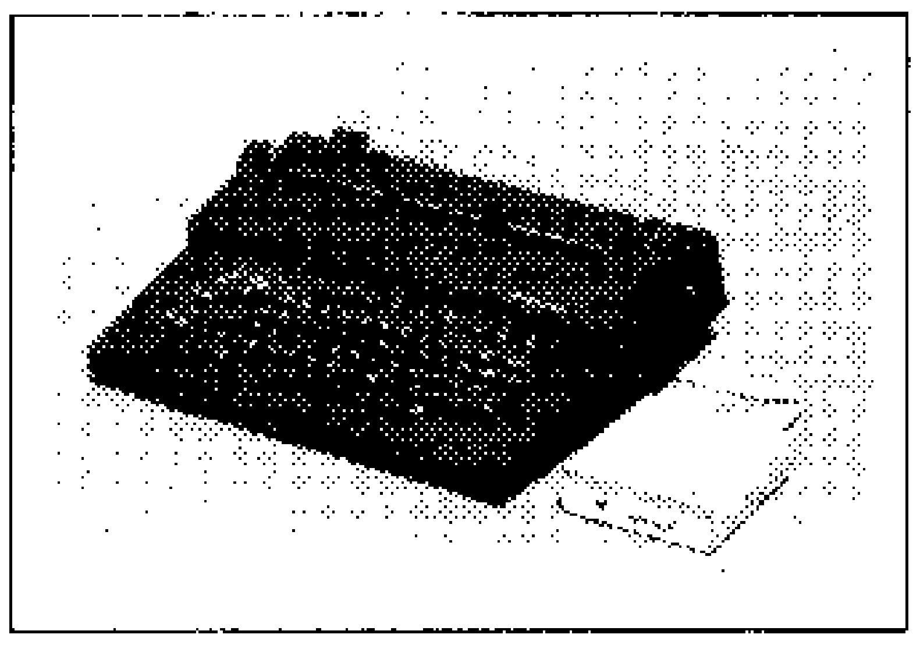

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in which the bug causes the sprites or turtle to misbehave, a pause will let you determine their states.

Use Traceback

If a program is set up to use subprocedures, you can see if they have actually been run by typing TRACEBACK. TRACEBACK prints the name of the programs being run, beginning with the "inner-most" nested program and ending with the largest superprocedure.

One can determine from TRACEBACK if subprocedures were not used or if the subprocedure never returns control to the original program. To check on variables or to use TRACEBACK later in the program, type CONTINUE and then repeat the pause checks as often as needed. Be sure not to edit the program while paused because that will stop it, returning to command level.

Sometimes, there is not enough information to use pause for bug-finding. In those cases, the programs can be "doctored" to include "dummy" variables which do nothing except count executions (which can then be checked while paused). Also, dummy commands can be added (e.g., COLORBACKGROUND :RUST) to subprocedures or to parts of programs which seem not to be working. Then, if the suspected code is executed, you can easily see it. Alternately, you could add commands such as :PRINT [I AM NOW RUNNING THE XXX LINE OF ZZZ]. Place different statements at each of the questionable spots.

There are an infinite number of beautiful designs that you can draw using recursion. For a sample, see the Abelson and DiSessa book, *Turtle Geometry.* Unfortunately, when I try to construct a recursive design, it often turns out different than intended. To help me see what the computer is doing, I frequently add large WAIT commands to the programs. By putting these waits just before or after a recursive call and by having a short and a long wait when there are two waits, I can readily understand just what the program tells the computer.

Other Options

A bug may be in one of two interfacing programs, such that each program runs fine alone, but not one after another.

The bug may be a "sneak by" bug from a stop rule.

Example: IF XCOR = 0 STOP

This could fail to stop if the XCOR moves from +1 to −1 without ever reaching 0 (this could happen in programs with a constant amount of horizontal motion and periodic checks of the XCOR). "Sneak by" bugs can be cured with better stop rules (e.g., IF XCOR < 1 STOP).

Finally, before pulling out hair, consider that the computer may have crashed! Usually a crash is obvious, because the keyboard is dead or the screen fills with funny characters. With some crash conditions, the computer recognizes it is crashing and types "CHOKE!" However, there are rare crashes, in which a portion of the operating system is disabled. I once saw a voltage spike leave all of the LOGO system intact, except for the letter tiles, which were grossly distorted. If the computer's air vents are blocked, you may sometimes produce a partial crash. On one occasion, I was demonstrating LOGO to a large convention audience when the portion of the operating system handling equality checks crashed so that it always answered "FALSE." Only after great embarrassment and agonized debugging did I decide that it may have overheated. When I let it cool off, booted the system, and brought the procedure back up, everything worked fine.

I hope the suggestions offered in this article will make for smoother forays into the rich hunting grounds of the LOGO language. Remember that the trail is easiest when you have a plan clearly mapped out.

Good hunting!

Letters on LOGO

99'er Magazine's contributing editor, Roger B. Kirchner, wrote this letter to* Byte Magazine *in response to an article published therein (August, 1982; Vol. 7, No. 8, p. 230) which compared various implementations of LOGO. Mr. Kirchner addresses some inaccuracies in that article's evaluation of TI LOGO.

Dear Sir:

Greg Williams' review of TI LOGO can only be described as prejudiced. TI LOGO does have defects, but they are not as serious as the review indicates.

One defect—that the turtle "runs out of ink"—doesn't occur before a significant amount of drawing is done. For example, the rectangle $-64 \le x \le 63$, $-47 \le y \le 48$ can be filled, and 192 8 x 8 tiles can be drawn on. The reason for the limitation is that the 99/4 uses the TMS9918 VDP, which does not have a dot graphics mode. The 99/4A, with the TMS9918A VDP, *does* have a dot graphics mode. (See Gary Kaplan's article in *99'er Magazine*, Vol. 1, No. 6, or your own Steve Ciarcia's article in *BYTE*, Vol. 7, No. 8, for the marvelous properties of this chip.) Tiles are probably used for drawing on to accomodate the 99/4; thus, it is the current implementation, not the machine (99/4A), which limits the graphics. With the Editor/Assembler module, 99/4A owners have full access to the TMS9918A's graphics, and it is only a matter of time before they will be accessible from LOGO.

The memory space for procedures is small, as Williams stated, but it will be doubled in TI LOGO II. Its present memory is enough for procedures to display and manipulate the Rubik cube.

The unrecoverable OUT OF SPACE and CHOKE! errors which Williams criticizes are unfortunate, but these, too, will be fixed in TI LOGO II.

Numbers in TI LOGO are limited to integers, but I have yet to see a significant application that is not possible in that language. (This is a challenge!) The trig functions *are* present because the velocity, speed, and heading of sprites can be set and interrogated.

The article's complaint that TI LOGO is lacking in its list processing capabilities is simply false. There is no empty word, it's true, but once this is realized, it causes no problems. (This anomaly is also being repaired in TI LOGO II.) And Williams' difficulty in trying to use word operations on numbers with the TI 99/4A is no problem when you accept that TI LOGO has three kinds of objects: words, lists, *and* numbers. I view this as an advantage. (Note: It is possible to generate a large number of different names without having to concatenate words and numbers.)

Problems with the 99/4A keyboard are overcome with practice: All keyboards have a problem in the QWERTY layout, and most are different from one another. At least all ASCII characters can be generated on the 99/4A keyboard.

It is an unsupported argument that the TI LOGO editor is less sophisticated than the other computers reviewed. The operator has full control of the screen. Problems with editing keys are resolved with practice. One should expect problems if an END is not supplied in a procedure definition, as Williams states. [*"...if you hit the Back key and the procedure being edited doesn't end with an END statement, TI Logo returns to the main Logo screen with a different prompt...In TI's defense, I must point out that each new procedure is automatically given an END statement when it is first edited; however, it is possible to erase the END statement during editing."*] It may be a convenience for the editor to supply the END, but there is no reason to expect that it should be supplied, nor that arguments to a procedure should be supplied before entering the edit mode. Being familiar with TI LOGO, I am not inclined to omit an END, and have no problems supplying arguments after entering the edit mode. (Note: TI LOGO II will accept arguments before or after entering edit mode.) If one is worried about botching a working procedure, a backup copy can be made by changing the name and exiting from edit mode.

The designers of TI LOGO are unfairly faulted for an "odd algorithm for evaluating LOGO phrases." The problem was that CHARNUM "B > CHARNUM "A didn't evaluate to TRUE as expected, but (CHARNUM "B) > (CHARNUM "A) does. This arises not from an "odd algorithm," but from a decision on the priority of operators. Most LOGO operators are *prefix* (operator followed by arguments), but some such as +, *, <, > have the conventional *infix* form. If all operators were prefix, there would be no problem with not using parentheses. Indeed, GREATER CHARNUM "B CHARNUM "A evaluates correctly to TRUE. But when prefix operators are combined with infix operators, ambiguous situations arise. The order of evaluation depends upon the priorities of the operators. In the case of TI LOGO, ">" has a higher priority than CHARNUM. In scanning from left to right, the interpreter evaluating CHARNUM "B > CHARNUM "A looks for the argument to the first CHARNUM. When it encounters the >, it evaluates the arguments of > is assumed to be "B. The second evaluates to 65 (CHARNUM "A). But > "doesn't like" the arguments "B and 65 and the interpreter gives an error. One can argue that prefix operators should have a higher priority than infix operators, but expressions are evaluated in a consistent way.

There are some problems with negative numbers because you can't put a negative number directly into a list. This is especially troublesome in reading negative numbers from the console, as −3 is parsed as − 3 (also, +3 is parsed as + 3). If negative numbers are to be read as inputs, you have to write a procedure to process the input.

Williams deserves thanks for pointing out that SENTENCE can take multiple inputs if you use parentheses—SENTENCE 2 3 4 will return [2 3], with the 4 unprocessed, but (SENTENCE 2 3 4) will return [2 3 4].

The TI-99/4A designers did a remarkable job, but an unrecognized one, I believe, because the documentation is so incomplete. TI LOGO is a full implementation of standard Logo, *and* it has sprites and tiles. (Harold Ableson's excellent books on Apple Logos contain good appendices on TI LOGO—except for the needlessly complex procedures for the dynaturtle and RANDOM1.) More documentation is needed, however, on the use of sprites and tiles. The value of sprites is obvious, but tiles give TI LOGO still another dimension, enabling the addition of background scenes as well as dynamic graphics. (See my Tower of Hanoi I, II in *99'er Magazine*, Vol. 1, Nos. 5, 6.)

Finally, I would like to quibble with Williams' benchmark tests. I find that TI LOGO does test 1 in 9.7 seconds (not 14.9 seconds, as stated in Table 4, p. 290 of the *BYTE* article). And even though it is "out of space" with a 26-element list, TI LOGO sorts a 22-element list in 5.8 (sometimes 4.8!) seconds. Thus, although TI LOGO is slower, it is not a factor-of-two slower. Also, the FILLPROC procedure used to test the computers in the articles is not a good guage of TI LOGO memory space; an auxiliary recursive procedure takes up extra space. Try the following, which generates procedures with names: A, AA, AAA, . . . Define:

```
TO FILLPROC  :N
TYPE [AT LEVEL] PRINT  :N
DEFINE  :PROCNAME [[ ]]
MAKE "PROCNAME WORD  :
  PROCNAME "A
FILLPROC  :N + 1
END
```

Then execute:

```
MAKE "PROCNAME "A
FILLPROC  1
```

TI LOGO is out of space at level 70. Since the procedure names get longer and longer, more space is required than with Williams' example (Listing 4, p. 264). This seems to show that TI LOGO has about a third the memory space of the Apple Logos, but remember the space reserved for sprites.

The article makes no mention of Apple Logo's apparent problem in overscrolling when more than a page of information is displayed—a difficulty that makes reviewing procedures almost impossible.

Apart from these criticisms, *BYTE*'s special issue on LOGO was very well done. Now, can Williams accept my challenge to come up with a significant application possible in Apple LOGO but not in TI LOGO?

Roger B. Kirchner
Professor of Mathematics
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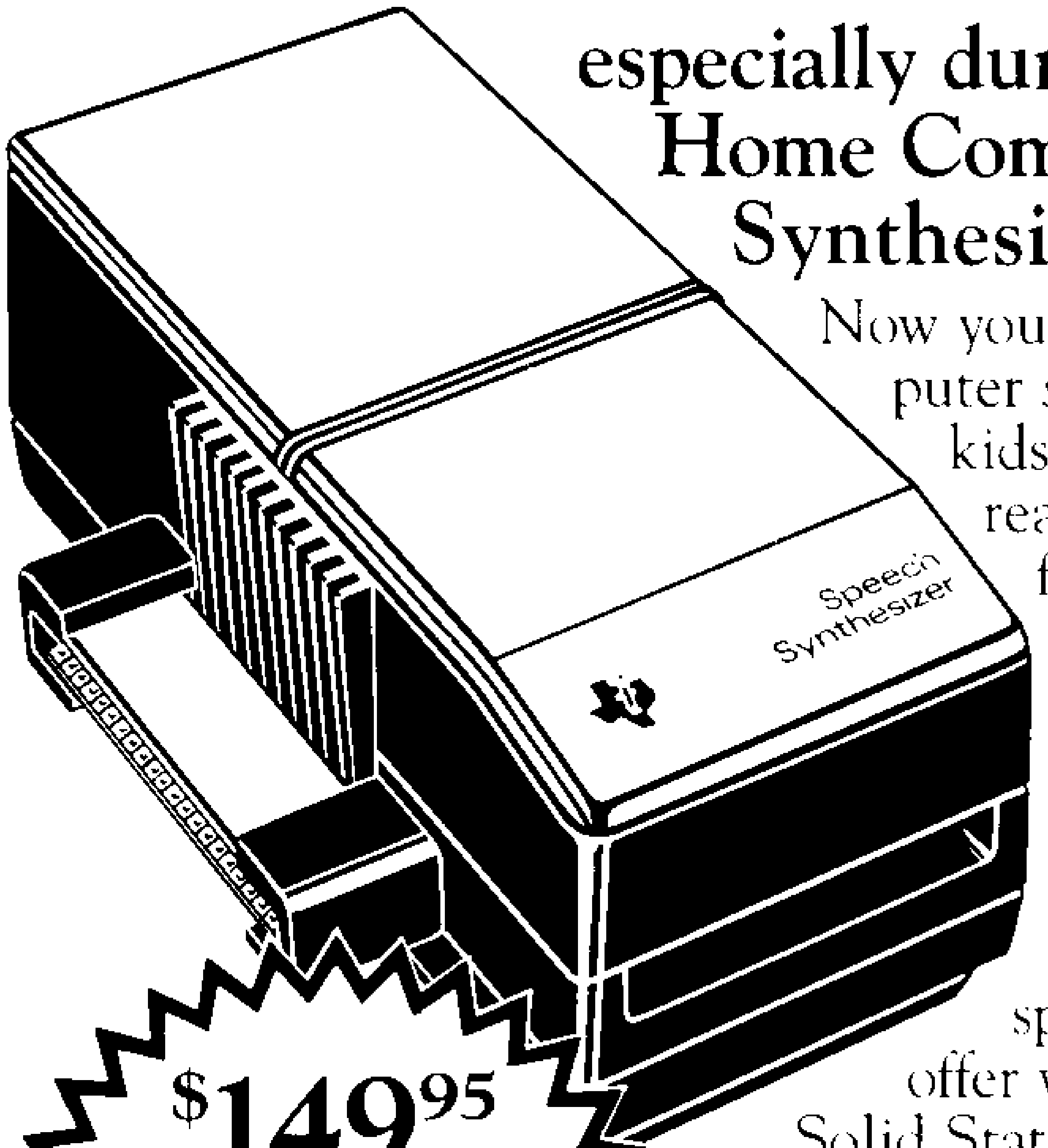

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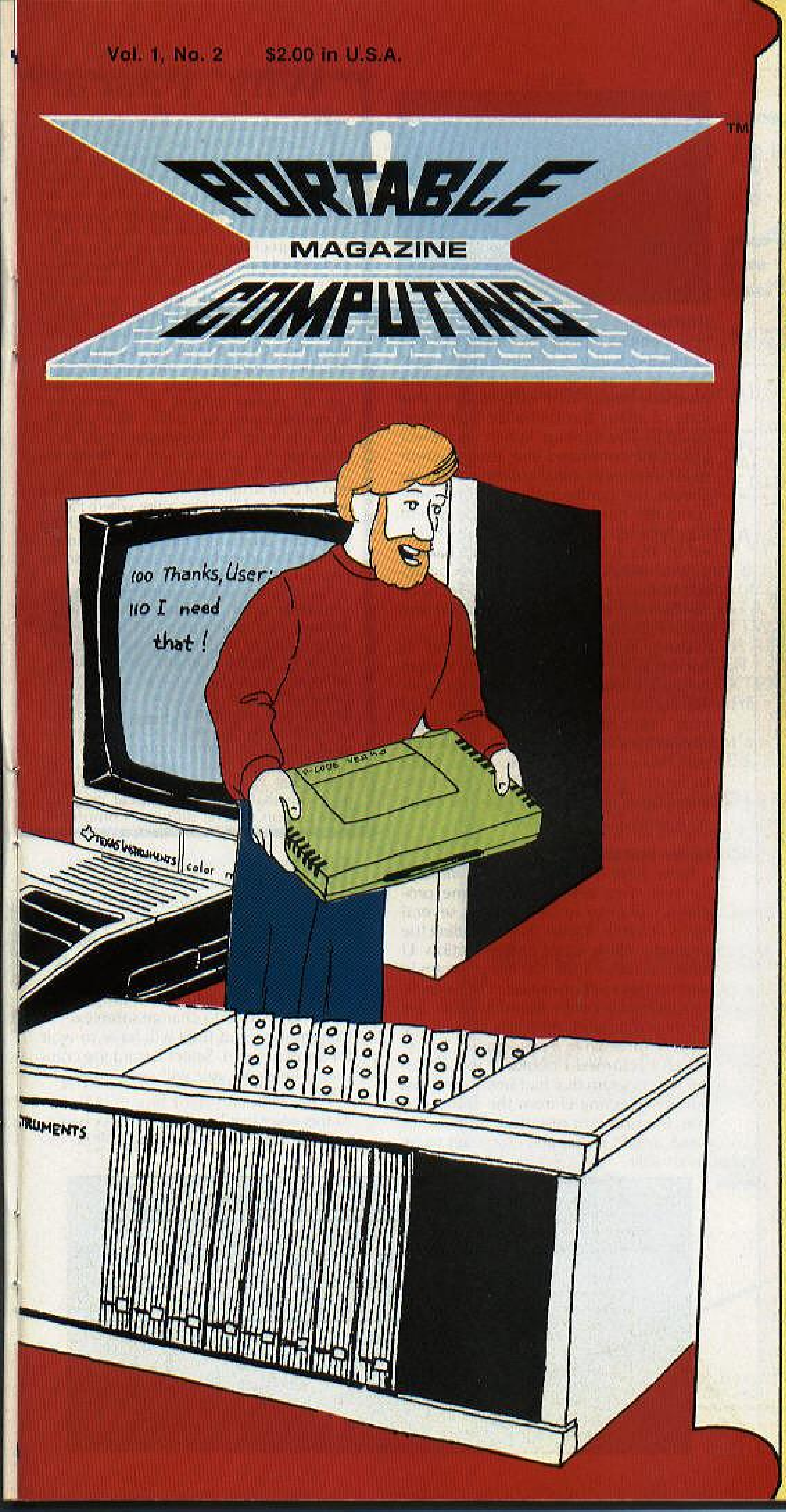

The p-System on the Home Computer
Part II

By David G. Brader

In this series of tutorials on the UCSD p-System, we hope to bring the world of portable software a little bit closer to you. Part one (see the Nov. 1982 issue of PCM) introduced the p-System and the TI p-Code Card. It showed how to install the card, how to fire up the Home Computer in its new configuration, and the use of the p-System **H**)alt command. That article described the minimum hardware necessary to actually use some programs written for the p-System. For your convenience, this list is reproduced as Table 1, and the chart of p-System commands as Figure 1.

Having covered the **H**)alt command, we move on to explore the unknown. . . Venture with us into the versatile realm of p-Code and portability to learn about three more simple commands—**I**(nitialize, **U**(ser restart, and **X**(ecute. And later, we will look into the method of loading a p-System program from cassette tape.

Because the U.C.S.D. p-System has been around for awhile, programs written for it existed long before it was offered for the TI Home Computer, and many of those programs can be transported easily to the TI-99/4A system by their authors. Simple *spreadsheet* programs to complex *data base management systems* will be offered very soon; however, many will require additional hardware above the minimum shown in Table #1. This ready pool of software already *debugged* on other computers, is a great resource just now being tapped. At this moment in various parts of the country, those mysterious beings known as computer programmers are making the simple changes needed for their programs to be usable on the Home Computer. Others are generating new programs to take advantage of the special features of the TI-99/4A—speech, color graphics, and the sixteen-bit processor. Won't it be great to have all this sophisticated software on your home system—the *same* system used for education and arcade entertainment?

Continued on p. 48

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Table 1

Components Required in a Minimum Configuration Home Computer p-System
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TI Peripheral Expansion Box("TI Box")
TI Memory Expansion Card
TI p-Code Card
TI Dual Cassette Cable
Tape cassette recorder/player

I)nitialize

Sometimes a program on your Home Computer will not function quite right because of complications caused by the program before it. If you suspect this state of affairs the **I**)nitialize command could fix you right up. When you select **I** from the command line, the p-System re-establishes its initial conditions. It also checks the configuration of the home computer hardware. If the disk system is connected, each drive will be checked by the system. If it doesn't have a p-System diskette, it won't be recognized. **I**)nitialize may be used to recheck the disk drives if you forgot to load one before starting the system.

Using the **I**)nitialize command is known as a "warm start" of the system because a few things are *not* reset to initial conditions. For a total reset or "cold start," turn off the power to the whole system for a minute and then follow normal power-up procedure. For a more technical explanation of any of these commands read the manual that came with your TI p-Code Card.

U)ser restart

Now, here is a time-saving command for you. You will find that some programs will need to be executed several times in a row. Rather than reloading the program each time, the selection **U** automatically causes the last program in memory to execute again. One simple keystroke! I recently found another use for this command. After working on the system for awhile I was called away. When I returned I couldn't remember the last program that had been executed but, by selecting **U** from the command line, the program restarted. Sometimes these *simple* commands turn out to be invaluable.

To understand why Niklaus Wirth o Zurich created the Pascal programming language, it helps to know something about the process of communicating with a computer. The reason for creating any new computer languag is to improve that communication; to read greater precision, to expand the range o expressable ideas, and to provide mor order.

It is possible to identify two major divisions in communication subject matter: (algorithms and (2) data structures. A algorithm is a step-by-step sequence of in structions leading to the solution of specific problem. Data structures ar logical representations of informatio (some examples are: tables, lists, and arrays). Professor Wirth designed the Pasca language in a way that clarifies the expression of algorithms as well as the construction of data structures. His success was firs acknowledged by universities where Pascal was found to be well suited for teaching computer programming. As programmers learned the advantages of the language, its popularity was assured.

Pascal forces the programmer to desig well-structured algorithms and well-defined data structures. This makes software easier to understand, a real benefi when it needs changes or additions. Although there are many versions o Pascal, the one generated by Kennet Bowles and his team at the University o California-San Diego (UCSD) is by far th most popular on small computers.

UCSD Pascal may be used on any computer that hosts the UCSD p-System—meaning that the same Pascal progra may run on several different computers.

X)ecute

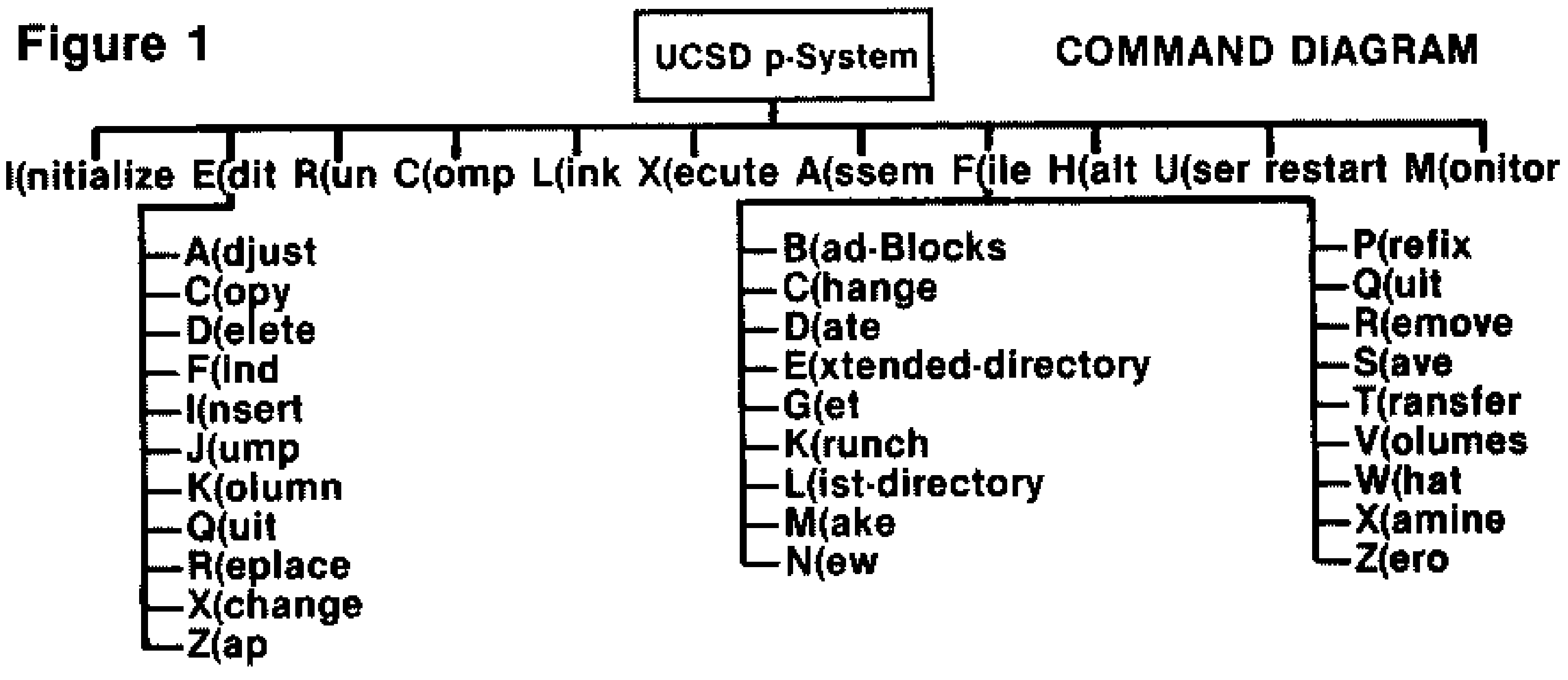
X)ecute really stands for execute and isn't an error. It was spelled without the leading "E" for good reason—a conflict of commands. The **E**)dit command also starts with "E," and **X**)ecute just made more sense than **D**)it . . . The main purpose for **X**)ecute is to start a program (it can also be used to change some execution options, but they will have to wait for another time). Select **X** from the command line and you will see:

What file?

At this point just key in the proper name, and the program in that file will be ex-

Figure 1

COMMAND DIAGRAM



By David G. Brader

Just to give you some idea what Pascal looks like, we list a program that sorts an array called "A" of numbers with "N" array positions:

```
PROCEDURE (*shell*)SORT(VARA: ARY;N:INTEGER);
VAR
  DONE: BOOLEAN;
  JUMP,I,J: INTEGER;
PROCEDURE SWAP(VAR P, Q:-REAL);
VAR
  HOLD: REAL;
BEGIN
  HOLD: = P;
  P: = Q;
  Q: = HOLD
END(*swap*);
BEGIN
  JUMP: = N;
  WHILE JUMP>1 DO
    BEGIN
     JUMP: = JUMPDIV2;
     REPEAT
       DONE: = TRUE;
       FORJ: = 1 TO N - JUMP DO
         BEGIN
           I: = J + JUMP;
           IF A[J]>A[1]THEN
             BEGIN
               SWAP(A[J],A[1]);
               DONE: = FALSE
           END(*IF*)
      END(*FOR*)
    UNTIL DONE
  END (*WHILE*)
END (*sort*)
```

There is a lot of action in just this short routine. Worth noting at this point are indentations that help show the structure of the program. This structure provides more order. Every variable and constant datatype is clearly defined before any use, increasing the precision of the language. Because algorithms can be clearly expressed in Pascal, it is easy to expand its range of ideas. That is "Why Pascal."

ecuted. (For the moment, we will bypass the naming of disk files on the p-System.)

Most p-System programs on cassette tape will load and execute with this easy procedure:

1. Place the p-System program in the cassette player making sure the player is properly connected to the TI-99/4A.
2. From the command line select X)ecute.
3. In answer to "What file?" type: TAPE: and then press ENTER.
4.
```
***************************
*REWIND TAPE-PRESS ANY KEY*
***************************
```
   will appear on the screen. Be sure the tape is fully rewound before pressing a key . . .
5.
```
**************************
*PRESS PLAY-PRESS ANY KEY*
**************************
```
   —go for it!
6. After loading, the program will automatically start execution, so it is up to you to remember to press STOP on the tape player . . .

Don't forget, if you want to use the same program again, and you have not turned off the system since last used, select U)ser restart from the command line.

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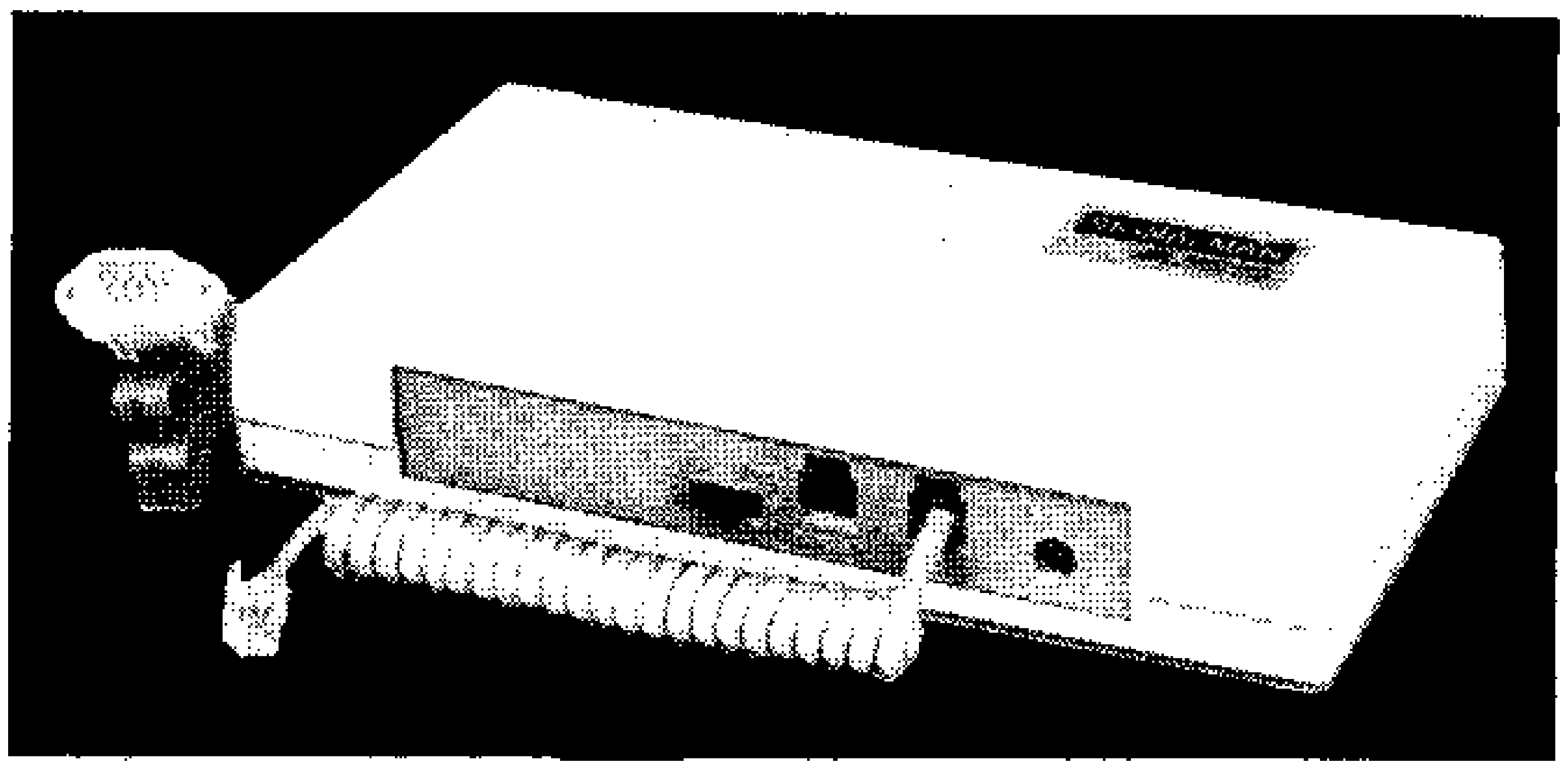

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Data Interface	TI RS-232C compatible, built-in cable to computer

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	MARK	1270 Hz	2225 Hz
	SPACE	1070 Hz	2025 Hz

Transmit Frequency Accuracy	±0.01%
Transmit Level	−12 dBm typical

Receive Frequency		ORIG	ANSW
	MARK	2225 Hz	1270 Hz
	SPACE	2025 Hz	1070 Hz

Receive Frequency Tolerance	±0.5%
Carrier Detect Threshold	−44 dBm typical
Carrier Detect Indicator	Audible tone
Power Requirement	Internal 9V transistor battery* or 110 VAC through adapter*
Size	8¼" x 4⅜" x 1⅜"

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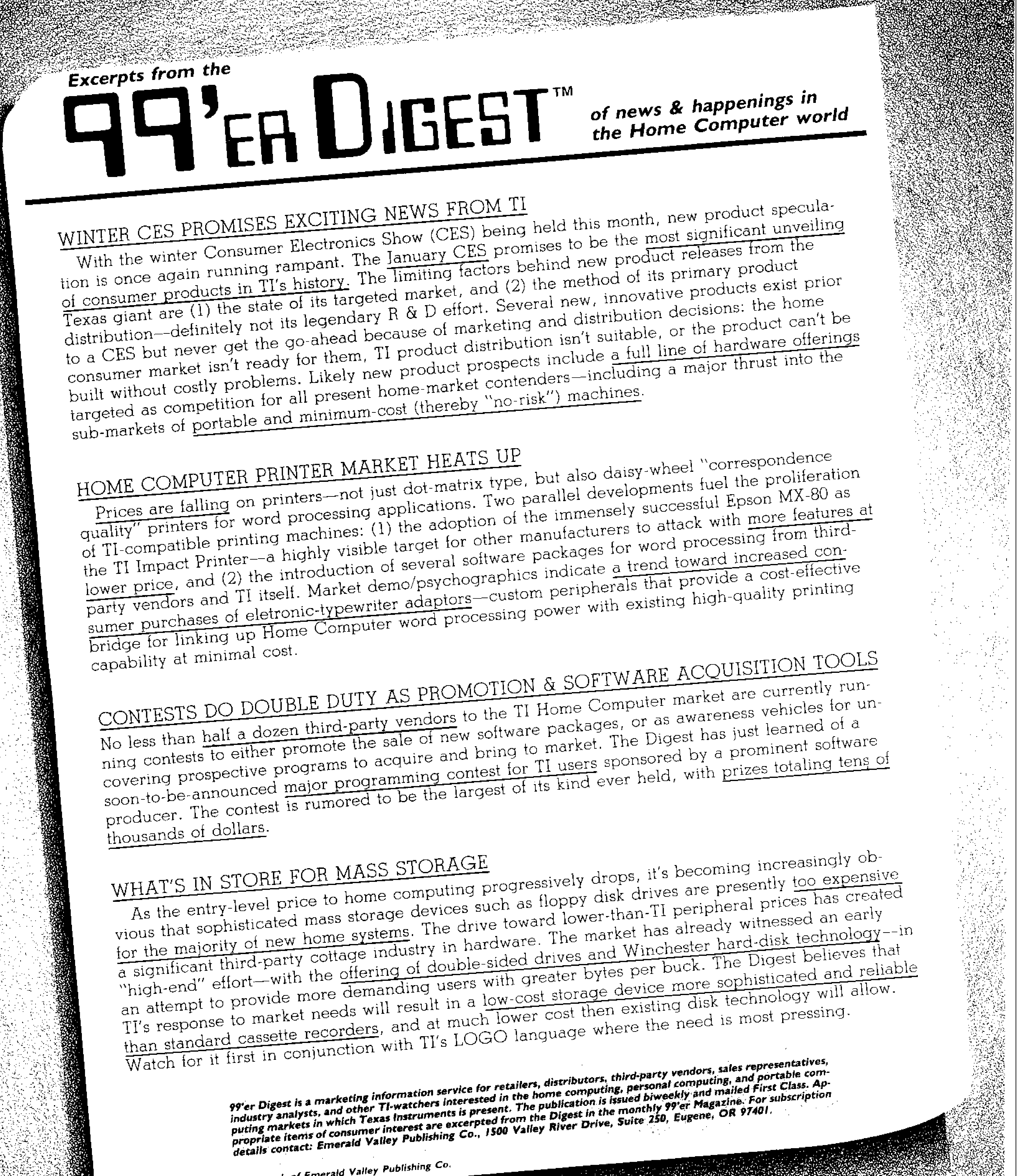

Excerpts from the

99'ER DIGEST™

of news & happenings in the Home Computer world

WINTER CES PROMISES EXCITING NEWS FROM TI

With the winter Consumer Electronics Show (CES) being held this month, new product speculation is once again running rampant. The January CES promises to be the most significant unveiling of consumer products in TI's history. The limiting factors behind new product releases from the Texas giant are (1) the state of its targeted market, and (2) the method of its primary product distribution—definitely not its legendary R & D effort. Several new, innovative products exist prior to a CES but never get the go-ahead because of marketing and distribution decisions: the home consumer market isn't ready for them, TI product distribution isn't suitable, or the product can't be built without costly problems. Likely new product prospects include a full line of hardware offerings targeted as competition for all present home-market contenders—including a major thrust into the sub-markets of portable and minimum-cost (thereby "no-risk") machines.

HOME COMPUTER PRINTER MARKET HEATS UP

Prices are falling on printers—not just dot-matrix type, but also daisy-wheel "correspondence quality" printers for word processing applications. Two parallel developments fuel the proliferation of TI-compatible printing machines: (1) the adoption of the immensely successful Epson MX-80 as the TI Impact Printer—a highly visible target for other manufacturers to attack with more features at lower price, and (2) the introduction of several software packages for word processing from third-party vendors and TI itself. Market demo/psychographics indicate a trend toward increased consumer purchases of eletronic-typewriter adaptors—custom peripherals that provide a cost-effective bridge for linking up Home Computer word processing power with existing high-quality printing capability at minimal cost.

CONTESTS DO DOUBLE DUTY AS PROMOTION & SOFTWARE ACQUISITION TOOLS

No less than half a dozen third-party vendors to the TI Home Computer market are currently running contests to either promote the sale of new software packages, or as awareness vehicles for uncovering prospective programs to acquire and bring to market. The Digest has just learned of a soon-to-be-announced major programming contest for TI users sponsored by a prominent software producer. The contest is rumored to be the largest of its kind ever held, with prizes totaling tens of thousands of dollars.

WHAT'S IN STORE FOR MASS STORAGE

As the entry-level price to home computing progressively drops, it's becoming increasingly obvious that sophisticated mass storage devices such as floppy disk drives are presently too expensive for the majority of new home systems. The drive toward lower-than-TI peripheral prices has created a significant third-party cottage industry in hardware. The market has already witnessed an early "high-end" effort—with the offering of double-sided drives and Winchester hard-disk technology--in an attempt to provide more demanding users with greater bytes per buck. The Digest believes that TI's response to market needs will result in a low-cost storage device more sophisticated and reliable than standard cassette recorders, and at much lower cost then existing disk technology will allow. Watch for it first in conjunction with TI's LOGO language where the need is most pressing.

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Engineering...from p.19

```
410 CALL CHAR(104,"000000FFFF")
420 CALL CHAR(105,"00001C1C1C080808
    ")
430 CALL CHAR(106,"000000F8F8080808
    ")
440 CALL CHAR(107,"080808F8F8")
450 CALL CHAR(108,"000000FFFF080808
    ")
460 CALL CHAR(109,"080808FFFF")
470 CALL CHAR(110,"0000383F3F38")
480 CALL CHAR(111,"00001CFCFC1C")
490 CALL COLOR(9,2,1)
500 CALL COLOR(10,2,1)
510 XO=9
520 YO=4
530 GOSUB 4600
540 YO=19
550 GOSUB 4780
560 XO=17
570 YO=4
580 GOSUB 4990
590 YO=19
600 GOSUB 5190
610 CALL CHAR(112,"00000000FF")
620 CALL CHAR(113,"00000406FF0604")
630 CALL CHAR(120,"003844447C4444")
640 CALL CHAR(121,"00784478444478")
650 CALL CHAR(122,"00384440404438")
660 A$=CHR$(120)
670 B$=CHR$(121)
680 C$=CHR$(122)
690 CALL COLOR(11,7,1)
700 CALL COLOR(12,7,1)
710 GOSUB 3610
720 RETURN
730 REM
740 REM    SUBM2 - DISPLAY SELECTIO
    N
750 GOSUB 3800
760 PRINT ::
770 GOSUB 5350
780 PRINT :::"PRESS"
790 PRINT :" 0 - STOP PROGRAM"
800 PRINT :" 1 - SERIES RESISTANCE"
810 PRINT :" 2 - PARALLEL RESISTANC
    E"
820 PRINT :" 3 - DELTA-Y CONVERSION
    "
830 PRINT :" 4 - Y-DELTA CONVERSION
    ":::
840 GOSUB 3880
850 CALL KEY(0,SEL,ST)
860 IF SEL<48 THEN 850
870 IF SEL>52 THEN 850
880 CALL CLEAR
890 IF SEL<>48 THEN 920
900 CALL SOUND(200,880,5)
910 STOP
920 SEL=SEL-48
930 CALL SCREEN(12)
940 RETURN
950 REN
960 REM  SUBA1 - SERIES RESISTANCE
970 REM
980 PRINT "  ** SERIES RESISTANCE *
    *"::::::::
990 XO=19
1000 YO=11
1010 GOSUB 5420
1020 GOSUB 3750
1030 PRINT ::"SERIES RESISTANCE IS
     THE"
1040 PRINT "SUM OF THE VALUES OF AL
     L"
1050 PRINT "THE SERIES RESISTORS."
1060 PRINT ::" RT = R1+R2+R3+...  O
     HMS"::
1070 GOSUB 3610
1080 GOSUB 5410
1090 PRINT :::"THE TOTAL RESISTANCE
      WILL"
1100 PRINT "ALWAYS BE GREATER THAN
     THE"
1110 PRINT "LARGEST SERIES RESISTOR
     ."
1120 RANDOMIZE
1130 NPROB=RAND(4)+1
1140 PRINT :::"NOW TRY";NPROB;"PROB
     LEMS ---":::
1150 GOSUB 3610
1160 FOR I1=1 TO NPROB
1170 GOSUB 5410
1180 PRINT :::"PROBLEM";I1::
1190 RT=0
1200 FOR I2=1 TO RAND(8)+1
1210 R=5*RAND(18)+5
1220 RT=RT+R
1230 PRINT " R"&STR$(I2);" =";R;"OH
     MS"
1240 NEXT I2
1250 PRINT
1260 INPUT " RT = ":RANS
1270 IF RANS=RT THEN 1330
1280 PRINT ::"OOPS!! -- REMEMBER TH
     AT"
1290 PRINT :" RT = R1+R2+R3+..."
1300 PRINT :" RT =";RT;"OHMS":::
1310 GOSUB 3610
1320 GOTO 1350
1330 PRINT :" ** CORRECT **"
1340 GOSUB 3680
1350 NEXT I1
1360 GOSUB 5410
1370 GOSUB 3990
1380 IF KEY=78 THEN 1530
1390 PRINT ::
1400 INPUT " OK - HOW MANY RESISTOR
     S? ":N
1410 IF N<=0 THEN 1510
1420 PRINT
1430 RT=0
1440 FOR I=1 TO N
```

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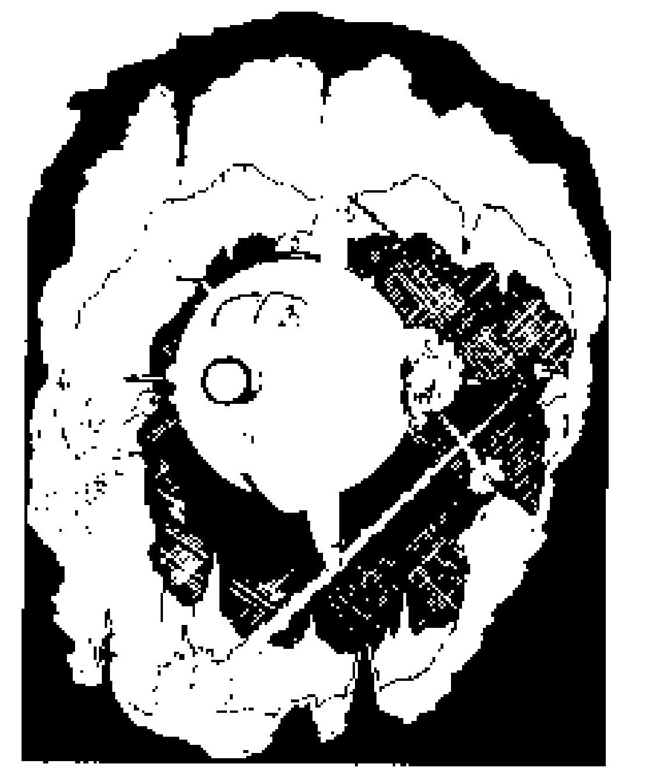
```
1450 INPUT " R"&STR$(I)&" = ":R
1460 RT=RT+R
1470 NEXT I
1480 PRINT :" RT =";RT:::
1490 GOSUB 3610
1500 GOTO 1360
1510 PRINT ::" ARE YOU KIDDING ME?!
     !"
1520 GOTO 1370
1530 RETURN
1540 REM
1550 REM  SUBA2 - PARALLEL RESISTAN
     CE
1560 PRINT " ** PARALLEL RESISTANCE
      **"::::::::
1570 XO=19
1580 YO=10
1590 GOSUB 5570
1600 GOSUB 3750
1610 PRINT ::"PARALLEL RESISTANCE I
     S"
1620 PRINT "COMPUTED WITH THE FORMU
     LA:"
1630 PRINT :"  1     1     1     1"
1640 PRINT " -- = -- + -- + -- + ..
     ."
1650 PRINT " RT    R1    R2    R3":::
1660 GOSUB 3610
1670 GOSUB 5560
1680 PRINT :::"PARALLEL RESISTANCE
     IS THE"
1690 PRINT "RECIPROCAL OF THE SUM O
     F"
1700 PRINT "THE RECIPROCAL VALUES O
     F"
1710 PRINT "ALL THE PARALLEL RESIST
     ORS."
1720 PRINT ::"THE TOTAL RESISTANCE
     WILL"
1730 PRINT "ALWAYS BE SMALLER THAN
     THE"
1740 PRINT "SMALLEST PARALLEL RESIS
     TOR."
1750 RANDOMIZE
1760 NPROB=RAND(4)+1
1770 PRINT ::"NOW TRY";NPROB;"PROBL
     EMS ---":::
1780 GOSUB 3610
1790 FOR I1=1 TO NPROB
1800 GOSUB 5560
1810 PRINT :::"PROBLEM";I1::
1820 RT=0
1830 FOR I2=1 TO RAND(4)+1
1840 R=10*RAND(9)
1850 RT=RT+1/R
1860 PRINT " R"&STR$(I2);" =";R;"OH
     MS"
1870 NEXT I2
1880 PRINT
1890 RT=1/RT
1900 INPUT " RT = ":RANS
1910 IF ABS(RANS-RT)<.001 THEN 1990
1920 PRINT ::"SORRY! -- THIS PROBLE
     M"
1930 PRINT "WAS NOT EASY."
1940 PRINT ::"REMEMBER THAT"
1950 PRINT :" RT = 1/(1/R1+1/R2+1/R
     3+...)"
1960 PRINT ::" RT =";RT;"OHMS":::
1970 GOSUB 3610
1980 GOTO 2010
1990 PRINT ::" ** CORRECT - VERY GO
     OD **"
2000 GOSUB 3700
2010 NEXT I1
2020 GOSUB 5560
2030 GOSUB 3990
2040 IF KEY=78 THEN 2230
2050 PRINT ::
2060 INPUT "OK - HOW MANY RESISTORS
     ? ":N
2070 IF N<=0 THEN 2200
2080 PRINT
2090 RT=0
2100 FOR I=1 TO N
2110 INPUT " R"&STR$(I)&" = ":R
2120 IF R<>0 THEN 2150
2130 PRINT :"SORRY - ZERO IS NOT AL
     LOWED"::
2140 GOTO 2110
2150 RT=RT+1/R
2160 NEXT I
2170 PRINT :" RT =";1/RT:::
2180 GOSUB 3610
2190 GOTO 2020
2200 PRINT ::"YOU'LL HAVE TO DO BET
     TER"
2210 PRINT "THAN THAT TO CATCH ME!!
     "
2220 GOTO 2030
2230 RETURN
2240 REM
2250 REM  SUBA3 - DELTA-Y CONVERSIO
     N
2260 PRINT "  ** DELTA-Y CONVERSION
      **"::::::::::
2270 GOSUB 6210
2280 PRINT ::"USE THESE THREE FORMU
     LAS TO"
2290 PRINT "CONVERT A DELTA-COMBINA
     TION"
2300 PRINT "TO AN EQUIVALENT"
2310 PRINT "Y-COMBINATION:"::::
2320 GOSUB 3610
2330 GOSUB 5710
2340 GOSUB 4220
2350 RANDOMIZE
2360 NPROB=RAND(3)+1
2370 PRINT :"NOW TRY";NPROB;"PROBLE
     MS ---"
2380 GOSUB 3610
2390 FOR I1=1 TO NPROB
2400 GOSUB 5710
```

Continued on p. 54



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SOURCE ID TCV774

Engineering...from p.53

```
2410 PRINT :::"PROBLEM";I1
2420 R1=5*RAND(18)+5
2430 R2=5*RAND(18)+5
2440 R3=5*RAND(18)+5
2450 PRINT ::" R1 =";R1
2460 PRINT " R2 =";R2
2470 PRINT " R3 =";R3::
2480 SUM=R1+R2+R3
2490 RA=R2*R3/SUM
2500 INPUT " RA = ":RAINP
2510 RB=R1*R3/SUM
2520 INPUT " RB = ":RBINP
2530 RC=R1*R2/SUM
2540 INPUT " RC = ":RCINP
2550 IF ABS(RA-RAINP)>.001 THEN 261
     0
2560 IF ABS(RB-RBINP)>.001 THEN 261
     0
2570 IF ABS(RC-RCINP)>.001 THEN 261
     0
2580 PRINT ::" ** CORRECT - VERY GO
     OD **"
2590 GOSUB 3700
2600 GOTO 2670
2610 PRINT ::" SORRY! -- REMEMBER T
     HAT"
2620 GOSUB 4220
2630 PRINT ::" R1 =";R1;" RA =";RA
2640 PRINT " R2 =";R2;" RB =";RB
2650 PRINT " R3 =";R3;" RC =";RC:::
     :
2660 GOSUB 3610
2670 NEXT I1
2680 GOSUB 5710
2690 GOSUB 3990
2700 IF KEY=78 THEN 2880
2710 PRINT ::"OK - ENTER PROBLEM --
     "::
2720 INPUT " R1 = ":R1
2730 INPUT " R2 = ":R2
2740 INPUT " R3 = ":R3
2750 SUM=R1+R2+R3
2760 IF SUM=0 THEN 2850
2770 RA=R2*R3/SUM
2780 PRINT ::" RA =";RA
2790 RB=R1*R3/SUM
2800 PRINT " RB =";RB
2810 RC=R1*R2/SUM
2820 PRINT " RC =";RC::::
2830 GOSUB 3610
2840 GOTO 2680
2850 PRINT ::"SORRY - THE SUM OF TH
     E THREE"
2860 PRINT "VALUES CANNOT BE ZERO."
2870 GOTO 2690
2880 RETURN
2890 REM
2900 REM  SUBA4 - Y-DELTA CONVERSIO
     N
2910 PRINT "  ** Y-DELTA CONVERSION
      **":::::::::
2920 GOSUB 6210
2930 PRINT ::"USE THESE THREE FORMU
     LAS"
2940 PRINT "TO CONVERT A Y-COMBINAT
     ION"
2950 PRINT "TO AN EQUIVALENT"
2960 PRINT "DELTA-COMBINATION"::::
2970 GOSUB 3610
2980 GOSUB 5710
2990 GOSUB 4340
3000 RANDOMIZE
3010 NPROB=RAND(3)+1
3020 PRINT :"NOW TRY";NPROB;"PROBLE
     MS ---"
3030 GOSUB 3610
3040 FOR I1=1 TO NPROB
3050 GOSUB 5710
3060 PRINT :::"PROBLEM";I1
3070 RA=5*RAND(18)+5
3080 RB=5*RAND(18)+5
3090 RC=5*RAND(18)+5
3100 PRINT ::" RA =";RA
3110 PRINT " RB =";RB
3120 PRINT " RC =";RC::
3130 SUM=RA*RB+RA*RC+RB*RC
3140 R1=SUM/RA
3150 INPUT " R1 = ":R1INP
3160 R2=SUM/RB
3170 INPUT " R2 = ":R2INP
3180 R3=SUM/RC
3190 INPUT " R3 = ":R3INP
3200 IF ABS(R1-R1INP)>.001 THEN 326
     0
3210 IF ABS(R2-R2INP)>.001 THEN 326
     0
3220 IF ABS(R3-R3INP)>.001 THEN 326
     0
3230 PRINT ::" ** CORRECT - VERY GO
     OD **"
3240 GOSUB 3700
3250 GOTO 3320
3260 PRINT ::" SORRY! -- REMEMBER T
     HAT"
3270 GOSUB 4340
3280 PRINT ::" RA =";RA;" R1 =";R1
3290 PRINT " RB =";RB;" R2 =";R2
3300 PRINT " RC =";RC;" R3 =";R3:::
     :
3310 GOSUB 3610
3320 NEXT I1
3330 GOSUB 5710
3340 GOSUB 3990
3350 IF KEY=78 THEN 3580
3360 PRINT ::"OK - ENTER PROBLEM --
     "::
3370 INPUT " RA = ":RA
3380 IF RA<>0 THEN 3410
3390 PRINT :"SORRY - RA CANNOT BE Z
     ERO"::
3400 GOTO 3370
3410 INPUT " RB = ":RB
3420 IF RB<>0 THEN 3450
```

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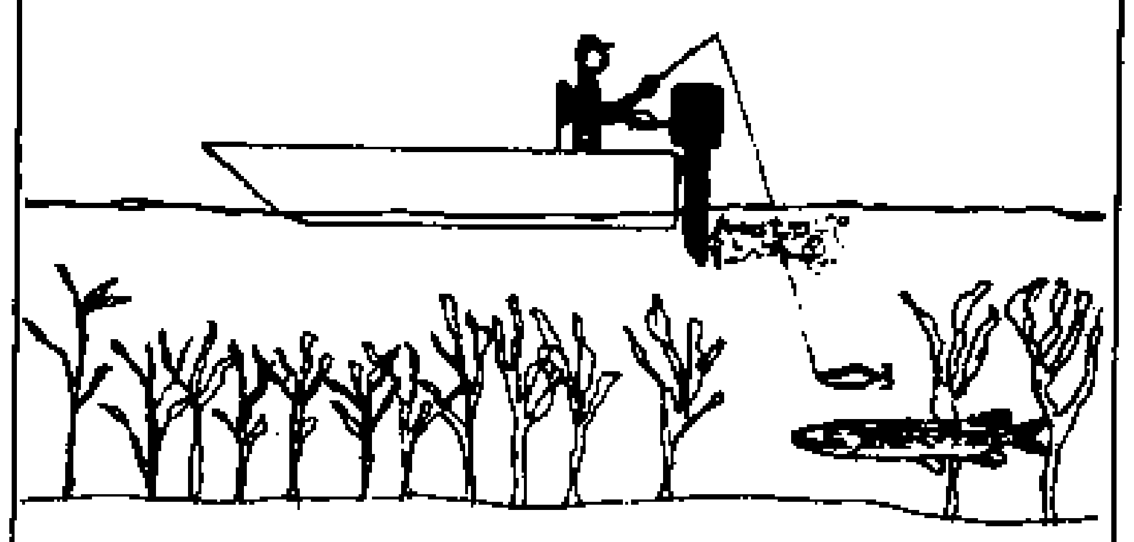

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This program requires only a cassette recorder and cables.

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```
3430 PRINT :"SORRY - RB CANNOT BE Z
     ERO"::
3440 GOTO 3410
3450 INPUT " RC = ":RC
3460 IF RC<>0 THEN 3490
3470 PRINT :"SORRY - RC CANNOT BE Z
     ERO"::
3480 GOTO 3450
3490 SUM=RA*RB+RA*RC+RB*RC
3500 R1=SUM/RA
3510 PRINT ::" R1 =";R1
3520 R2=SUM/RB
3530 PRINT " R2 =";R2
3540 R3=SUM/RC
3550 PRINT " R3 =";R3::::
3560 GOSUB 3610
3570 GOTO 3330
3580 RETURN
3590 REM
3600 REM  SUBU1 - UTILITY PROMPTER
3610 PRINT "<ENTER> TO CONTINUE --"
     ;
3620 CALL SOUND(150,1397,4)
3630 CALL KEY(0,KEY,ST)
3640 CALL COLOR(11,1,1)
3650 CALL COLOR(11,7,1)
3660 IF KEY<>13 THEN 3630
3670 RETURN
3680 REM
3690 REM  SUBU2 - UTILITY DELAY
3700 FOR DELAY=1 TO 1000
3710 NEXT DELAY
3720 RETURN
3730 REM
3740 REM  SUBU3 - COMMON STATEMENT
3750 PRINT :::"RESISTANCE IS MEASUR
     ED"
3760 PRINT "IN UNITS CALLED OHMS."
3770 RETURN
3780 REM
3790 REM  SUBU4 - MAKE CHARACTERS I
     NVISABLE
3800 CALL CLEAR
3810 CALL SCREEN(12)
3820 FOR I=1 TO 8
3830 CALL COLOR(I,1,12)
3840 NEXT I
3850 RETURN
3860 REM
3870 REM  SUBU5 - MAKE CHARACTERS V
     ISIBLE
3880 CALL VCHAR(1,1,32,24)
3890 CALL VCHAR(1,2,32,24)
3900 CALL VCHAR(1,31,32,24)
3910 CALL SCREEN(5)
3920 FOR I=8 TO 1 STEP -1
3930 CALL COLOR(I,2,12)
3940 NEXT I
3950 CALL SOUND(150,1397,4)
3960 RETURN
3970 REM
3980 REM  SUBU6 - YES/NO QUERY
3990 PRINT ::::"DO YOU HAVE A PROBL
     EM"
4000 PRINT "FOR ME? (Y/N) ";
4010 CALL SOUND(200,1397,2)
4020 CALL KEY(0,KEY,ST)
4030 CALL COLOR(11,1,1)
4040 CALL COLOR(11,7,1)
4050 IF KEY<78 THEN 4020
4060 IF KEY=78 THEN 4090
4070 IF KEY<>89 THEN 4020
4080 PRINT "Y"
4090 RETURN
4100 REM
4110 REM  SUBU7 - COMMON STATEMENT
     S
4120 PRINT ::"COMBINATIONS OF THREE
     "
4130 PRINT "RESISTORS IN A ""DELTA"
     ""
4140 PRINT "OR ""Y"" SOMETIMES APPE
     AR"
4150 PRINT "IN NETWORKS."
4160 PRINT :"SUCH NETWORKS OFTEN CA
     NNOT"
4170 PRINT "BE REDUCED BY SIMPLE SE
     RIES-"
4180 PRINT "PARALLEL REDUCTION FORM
     ULAS."::
4190 RETURN
4200 REM
4210 REM  SUBU8 - DELTA-Y FORMULAS
4220 PRINT :TAB(13);"R2*R3"
4230 PRINT TAB(7);"RA = ------ --"
4240 PRINT TAB(12);"R1+R2+R3"
4250 PRINT :TAB(13);"R1*R3"
4260 PRINT TAB(7);"RB = ---------"
4270 PRINT TAB(12);"R1+R2+R3"
4280 PRINT :TAB(13);"R1*R2"
4290 PRINT TAB(7);"RC = ---------"
4300 PRINT TAB(12);"R1+R2+R3"
4310 RETURN
4320 REM
4330 REM  SUBU9 - Y-DELTA FORMULAS
4340 PRINT :"       RA*RB + RA*RC +
     RB*RC"
4350 PRINT " R1 = -----------------
     ----"
4360 PRINT TAB(16);"RA"
4370 PRINT :"       RA*RB + RA*RC +
     RB*RC"
4380 PRINT " R2 = -----------------
     ----"
4390 PRINT TAB(16);"RB"
4400 PRINT :"       RA*RB + RA*RC +
     RB*RC"
4410 PRINT " R3 = -----------------
     ----"
4420 PRINT TAB(16);"RC"
4430 RETURN
4440 REM
4450 REM  SUBU10 - DRAW HORIZONTAL
     RESISTOR
```

Continued on p. 56

OMEGA FORCE

In the year 3050 a new super race of Carsinians began to dominate the Universe. The Carsinians used a new battle technique unfamiliar to Humans. The Human race was at the point of extinction. However the humans developed a new training technique known as OMEGA FORCE.....Joysticks Ext Basic required Similiar to the Arcade game. **$12.95**

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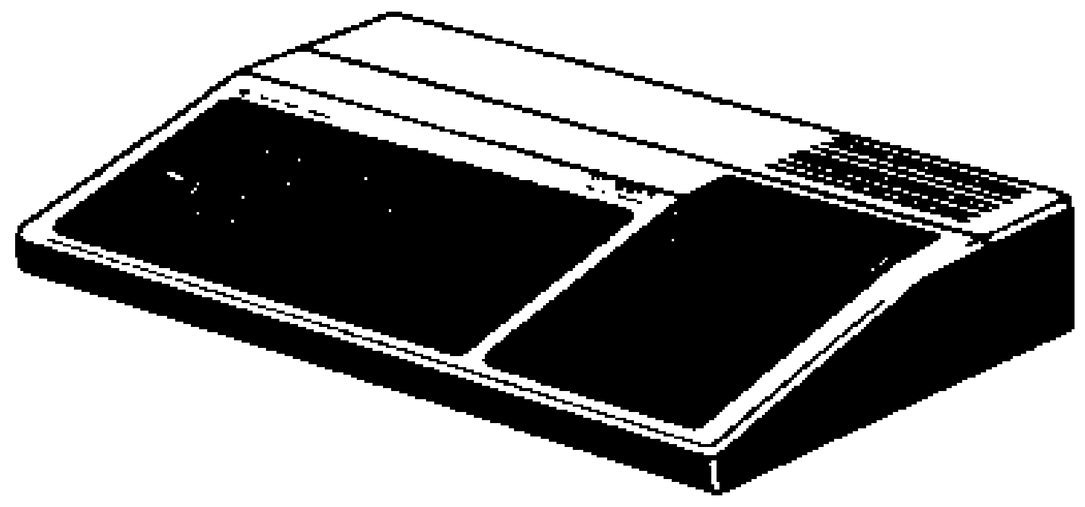

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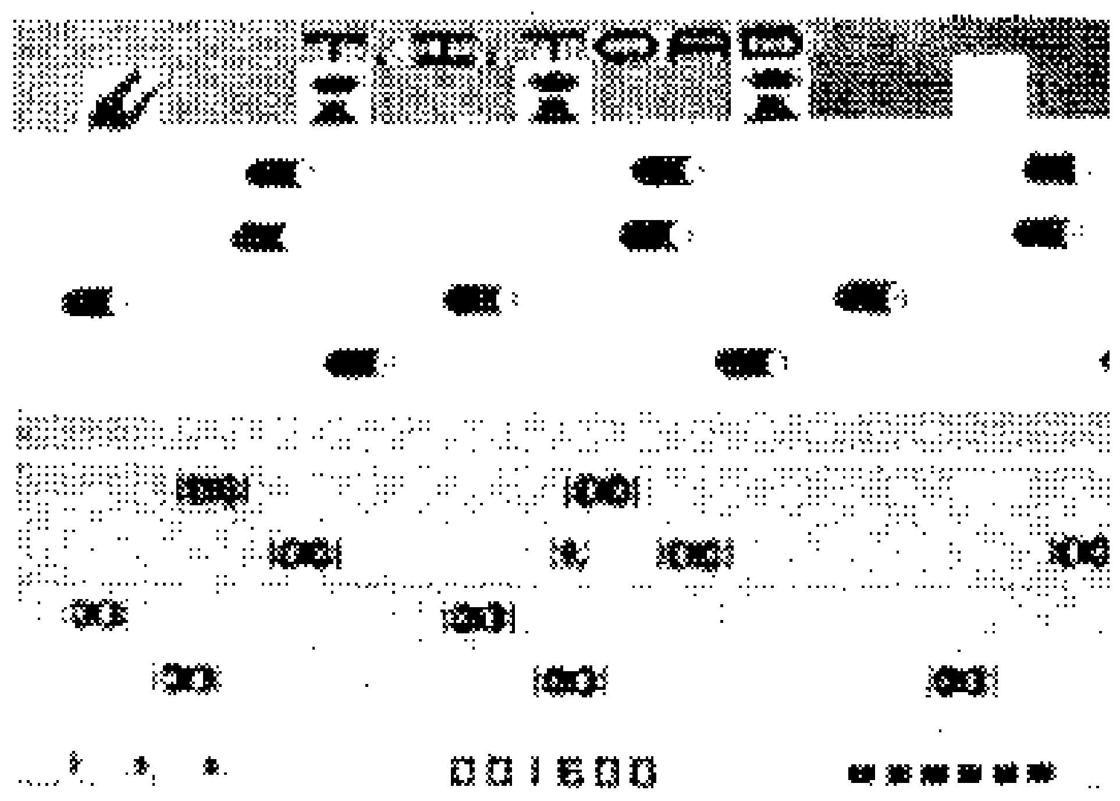
T.I.TOAD



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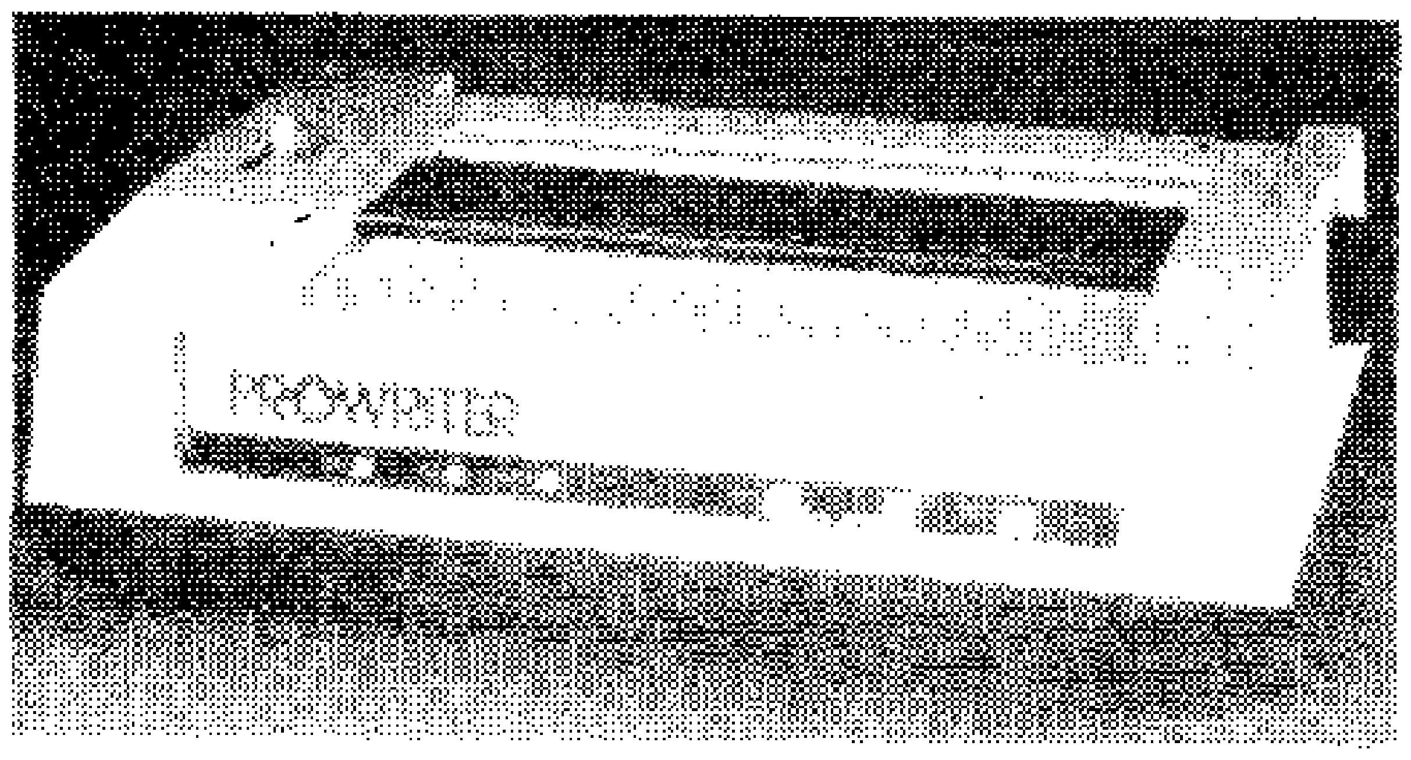
Box 18051, Denver, CO 80218

Engineering...from p.55

```
4460 CALL HCHAR(X,Y,96)
4470 CALL HCHAR(X,Y+1,97)
4480 CALL HCHAR(X,Y+2,98)
4490 CALL HCHAR(X,Y+3,99)
4500 RETURN
4510 REM
4520 REM  SUBU11 - DRAW VERTICAL RE
     SISTOR
4530 CALL HCHAR(X,Y,100)
4540 CALL HCHAR(X+1,Y,101)
4550 CALL HCHAR(X+2,Y,102)
4560 CALL HCHAR(X+3,Y,103)
4570 RETURN
4580 REM
4590 REM  SUBU12-DRAW SERIES CIRCUI
     T
4600 CALL HCHAR(XO,YO,110)
4610 CALL HCHAR(XO,YO+1,104,8)
4620 X=XO
4630 Y=YO+3
4640 GOSUB 4460
4650 Y=YO+9
4660 CALL HCHAR(X,Y,106)
4670 X=XO+1
4680 GOSUB 4530
4690 X=XO+5
4700 CALL HCHAR(X,Y,107)
4710 CALL HCHAR(X,YO,110)
4720 CALL HCHAR(X,YO+1,104,8)
4730 Y=YO+3
4740 GOSUB 4460
4750 RETURN
4760 REM
4770 REM  SUBU13-DRAW PARALLEL CIRC
     UIT
4780 CALL HCHAR(XO,YO,110)
4790 CALL HCHAR(XO,YO+1,104,9)
4800 CALL HCHAR(XO,YO+2,108)
4810 CALL HCHAR(XO,YO+6,108)
4820 CALL HCHAR(XO,YO+10,106)
4830 X=XO+1
4840 Y=YO+2
4850 GOSUB 4530
4860 Y=YO+6
4870 GOSUB 4530
4880 Y=YO+10
4890 GOSUB 4530
4900 X=XO+5
4910 CALL HCHAR(X,YO,110)
4920 CALL HCHAR(X,YO+1,104,9)
4930 CALL HCHAR(X,YO+2,109)
4940 CALL HCHAR(X,YO+6,109)
4950 CALL HCHAR(X,Y,107)
4960 RETURN
4970 REM
4980 REM  SUBU14-DRAW DELTA CIRCUIT
4990 CALL HCHAR(XO,YO,110)
5000 CALL HCHAR(XO,YO+1,104,8)
5010 CALL HCHAR(XO,YO+2,108)
5020 CALL HCHAR(XO,YO+9,106)
5030 X=XO+1
5040 Y=YO+2
5050 GOSUB 4530
5060 Y=YO+9
5070 GOSUB 4530
5080 X=XO+5
5090 CALL HCHAR(X,YO,110)
5100 CALL HCHAR(X,YO+1,104,8)
5110 CALL HCHAR(X,YO+2,109)
5120 CALL HCHAR(X,YO+9,109)
5130 CALL HCHAR(X,YO+10,111)
5140 Y=YO+4
5150 GOSUB 4460
5160 RETURN
5170 REM
5180 REM  SUBU15-DRAW Y CIRCUIT
5190 Y=YO+5
5200 CALL HCHAR(XO,Y,105)
5210 X=XO+1
5220 GOSUB 4530
5230 X=XO+5
5240 CALL HCHAR(X,YO,110)
5250 CALL HCHAR(X,YO+1,104,9)
5260 CALL HCHAR(X,YO+10,111)
5270 CALL HCHAR(X,YO+5,109)
5280 Y=YO+1
5290 GOSUB 4460
5300 Y=YO+6
5310 GOSUB 4460
5320 RETURN
5330 REM
```

Continued on p. 66



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PLATO. . .from p.16

of kids coming out of high schools without basic skills. It's just going to shut it off."

It is only right that Norris is at last seeing his dream come true. This has been his pet. He has been the believer, the monk, the keeper of the scrolls who defended this body of learning through two decades of dark ages—when any 20th-century, marketing consultant would have advised, tongue-in-cheek, "Get out of illuminated manuscripts and concentrate on Cognac."

Norris has even outdone the monks who preserved the basic tenets of civilization laid down by ancient Greek idealists. He has not only stored up and preserved knowledge, but also has given us, once again, that priceless classical system of education—the method of one-to-one. A tradition thought lost for more than 2,000 years is now awakening in another Golden Age.

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For more information write:
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Super Language. . .from p.23

1. by the RUN option in the Mini-Memory menu
2. from console BASIC
3. from EASY BUG

The EASY BUG way is simplest because you can do it immediately. Enter EASY BUG, hit a key to get past its menu, and enter Exxxx, where xxxx is the hexadecimal address at which your program starts. That's all there is to it.

To run your program the other two ways, a six-character program name and its starting address (2 bytes) must be present in the REF/DEF table (see figure 1). When you first load the Line-By-Line Assembler from the cassette tape, the program LINES is resident in the Mini-Memory too. The REF/DEF table entry for LINES is at >7FE8. If you have entered your own program via the Line-By-Line Assembler, then your program has obliterated at least a part of LINES, so you might as well reuse its REF/DEF entry for your own. Put your program name and starting address in the 8 bytes starting at >7FE8 using the Line-By-Line Assembler (explained in the book which comes with it) or with EASY BUG's M command. Once your program information has been loaded in the REF/DEF table, you can RUN it from the Mini-Memory by name, or branch to it from console BASIC via the CALL LINK subroutine.

More on EASY BUG

EASY BUG really is an easy way to see what your program did, but first you have to make a few preparations. As you enter your source program via the Line-By-Line Assembler, make notes of the memory locations used, especially for data areas. Then when the program doesn't execute properly, you can use EASY BUG to "peek" at your data areas (or what's left of them). Use the M command to view or change CPU RAM and V to view VDP RAM locations. I have debugged several small programs this way.

Conclusion

The Line-By-Line Assembler is a great way to find out if Assembly Language programming appeals to you—without spending an arm and a leg. Although it is somewhat limited and inconvenient, it is adequate for writing shortish Assembly Language programs. It also gives you excellent insights into the machine and its instruction set.

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Cyber-Dice...from p.35

```
970 NEXT B :: GOTO 1030
980 PT=D(1)+D(2)+D(3)+D(4)+D(5):: GOTO 1090
990 FOR B=1 TO 6 :: IF DV(B)=0 THEN T=0 ELSE T=T+1 :
    : IF T=H-7 THEN ON T-2 GOTO 1070,1060
1000 NEXT B :: GOTO 1030
1010 PT=DV(H)*H :: IF PT THEN 1090
1020 IF S(A,G,H)>-1 THEN 540
1030 IF H<>12 THEN DISPLAY AT(24,1)BEEP:"  INPUT ZER
     O SCORE?(Y/N) Y" ELSE 1090
1040 ACCEPT AT(24,26)SIZE(-1):M$ :: CALL HCHAR(24,3,
     32,26):: IF M$="Y" THEN 1090
1050 FOR T=1 TO 70 :: NEXT T :: GOTO 540
1060 PT=10
1070 PT=PT+5
1080 PT=PT+25
1090 S(A,G,H)=PT :: YT,PT,E1=0 :: IF H>6 THEN 1130
1100 FOR B=1 TO 6 :: IF S(A,G,B)=-1 THEN E1=1 ELSE P
     T=PT+S(A,G,B)
1110 NEXT B :: S(A,G,15)=PT
1120 IF E1=1 THEN 1150 ELSE S(A,G,15)=PT*G :: IF PT<
     52 THEN 1150 ELSE S(A,G,16)=S(A,G,16)+35*G :: G
     OTO 1150
1130 FOR B=7 TO 13 :: IF S(A,G,B)>-1 THEN PT=PT+S(A,
     G,B)
1140 NEXT B :: S(A,G,14)=PT*G
1150 GOSUB 1250 :: FOR G=1 TO Z
1160 FOR H=14 TO 16 :: GT(A)=GT(A)+S(A,G,H):: NEXT H
      :: NEXT G :: DISPLAY AT(A+2,1)SIZE(4):USING "#
     ###":GT(A)
1170 NEXT A :: IF R=13*Z THEN 1280 ELSE R=R+1 :: DIS
     PLAY AT(20,7)SIZE(2):USING "##":R :: GOTO 400
1180 FOR V=1 TO 300 :: NEXT V
1190 CALL CLEAR :: CALL SCREEN(8):: FOR V=1 TO 200 :
     : NEXT V :: RETURN
1200 READ Y
1210 READ X,M$
1220 DISPLAY AT(Y,X):M$ :: RETURN
1230 FOR X=1 TO Z :: FOR Y=12 TO 14
1240 CALL VCHAR(3,5*X+Y,32,16):: NEXT Y :: NEXT X ::
      FOR G=1 TO Z :: GOSUB 1250 :: NEXT G :: RETURN
1250 FOR H=1 TO 16
1260 IF S(A,G,H)>(H<14)THEN CALL SOUND(25,1470,4)::
     DISPLAY AT(H+2,10+5*G)SIZE(3):USING "###":S(A,G
     ,H)
1270 NEXT H :: RETURN
1280 RESTORE 1540 :: GOSUB 1180 :: FOR B=1 TO 3 :: G
     OSUB 1200 :: NEXT B
1290 FOR Y=8 TO 6+2*Q5 STEP 2
1300 DISPLAY AT(Y,4):Q$(Y/2-3);TAB(22);GT(Y/2-3):: N
     EXT Y
1310 FOR I=1 TO 500 :: NEXT I
1320 GOSUB 1200 :: ACCEPT AT(24,20)SIZE(-1):M$ :: GO
     SUB 1180 :: IF M$="Y" THEN 340 ELSE STOP
1330 DATA 104,0000001818,99,103070FF70301,120,0000FF
     FFFF,105,00
1340 DATA 128,103070FF70301,119,0,7,11,2,16,1,11,7,1
     ,16,11,3,8
1350 DATA C  Y  B  E  R,6,9,D  I  C  E
1360 DATA 12,3,HOW MANY PLAYERS?(1-6) 2,2,"YOU MAY P
     LAY 1,2 OR 3 GAMES",1,SIMULTANEOUSLY.  THE POIN
     TS
1370 DATA 1,SCORED ARE MULTIPLIED BY THE
1380 DATA 1,"GAME NUMBER, MAKING STRATEGY",1,MORE IM
     PORTANT.,1,"",2,WHICH GAME TO PLAY?(1-3) 3
1390 DATA 2,INDICATE DICE TO KEEP BY:
1400 DATA 1,"",3,1. TYPING DICE VALUE.,3,2. 'A'  KEE
     PS ALL FOUR.,3,3. ZERO CLEARS ALL FOUR.
1410 DATA 3,4. 'R' FOLLOWED BY A VALUE
1420 DATA 6,CLEARS ONE DICE OF THAT,6,VALUE.,1,PRESS
      SPACE BAR TO ROLL DICE,1,USE ARROW KEYS TO IND
     ICATE
1430 DATA 1,CATEGORY AND GAME TO SCORE
1440 DATA 1,"IN, THEN PRESS ENTER KEY."
1450 DATA 1,THE COMPUTER CHECKS THAT YOU,1,QUALIFY F
     OR THAT CATEGORY,1,THEN PRINTS YOUR SCORE.
1460 DATA 1,"",1,CUBE'S HAVE SPECIAL RULES
1470 DATA 1,FOR SCORING. ALL YOU NEED TO,1,DO TO SCO
     RE A CUBE IS TO,1,INDICATE WHICH GAME TO SCORE
1480 DATA 1,IT IN. THE COMPUTER WILL DO,1.THE REST.,
     1,"",3,PRESS ENTER TO CONTINUE
1490 DATA 1,"*CYBER-DICE*     GAME NUMBER"
1500 DATA 15,*1*  *2*  *3*,5,*ONES..*,5,*TWOS..*,5,*
     THREES*,5,*FOURS.*,5,*FIVES.*,5,*SIXES.*
1510 DATA 1,3 OF A KIND*,1,*****CUBE.*
1520 DATA 1,**TWO PAIR.*,1,S.STRAIGHT.*,1,L.STRAIGHT
     .*,1,*NO CHANCE.*,1,****CHANCE.*,1,LOWER TOTAL:
1530 DATA 1,UPPER TOTAL:,1,TOTAL BONUS:,1,"",1,ROUND
     :1  ROLL:
1540 DATA 2,6,** CYBER-DICE **,4,9,FINAL  SCORES,6,4
     ,PLAYER            SCORE,24,7,REPLAY?(Y/N) Y,
1550 DATA ,**,"!",E,B,U," C",**
```

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NEW CASINO GAME

Dynamic Data and Devices has just announced a new "casino" game *Quimbee*, written by Curtis Garcia. *Quimbee*, similar to 99'er Magazine's Cyber-Dice program, uses six dice, offers "jeopardy rolls," has the ability to store a game, and reviews scores after a game is over. It stores high scores and prints out any information desired. *Quimbee* is available in Extended BASIC on disk or casette from Dynamic Data and Devices, P. O. Box 912, Stafford, Texas 77477.

TI COMPUTER ADVANTAGE CLUB OFFERING NEW COURSES

Hands-on training in computer skills is available from Texas Instruments through a series of five courses; three for children and two for adults. No prior computer experience is required. *Children's Computer Awareness Program* consists of 10 hours of instruction that familiarizes children ages 8 to 15 with computer software, including programming in TI BASIC and TI LOGO. The cost is $65. *Programming Discovery in TI LOGO* provides in-depth experience in TI LOGO for children ages 8 to 15. This ten-hour course teaches geometrical, mathematical, and logical concepts and stimulates creativity in problem-solving ability. The cost is $65. *Programming Discovery in TI BASIC* is a 10-hour course for children ages 8 to 15, introducing BASIC programming concepts through implementation of sound, color graphics, music, and speech. The cost is $65. *Adult Computer Awareness Program* offers ten hours of training designed for the office, and extensive hands-on and problem solving exercises using TI Solid State software. Programming is in TI LOGO and TI BASIC. The cost is $75. *Basic Programming for Adults* consists of ten hours of basic programming instruction and hands-on creation of programs, incorporating features of the TI-99/4A in BASIC commands. The cost is $75. Additional family members enrolling in any course receive $10 discount on tuition. Enrollment is by calling the toll free numbers and finding the date, time, and locations available locally: Tel. 1-800-858-4069. In Texas call 1-800-692-1318. Additional contact: Texas Instruments, TI Computer Advantage Club, P. O. Box 10508 M/S 5898, Lubbock, Texas 79408.

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Micro Peripherals, Inc. has recently lowered the price of its popular dot matrix printer to $695, a reduction of about $100.

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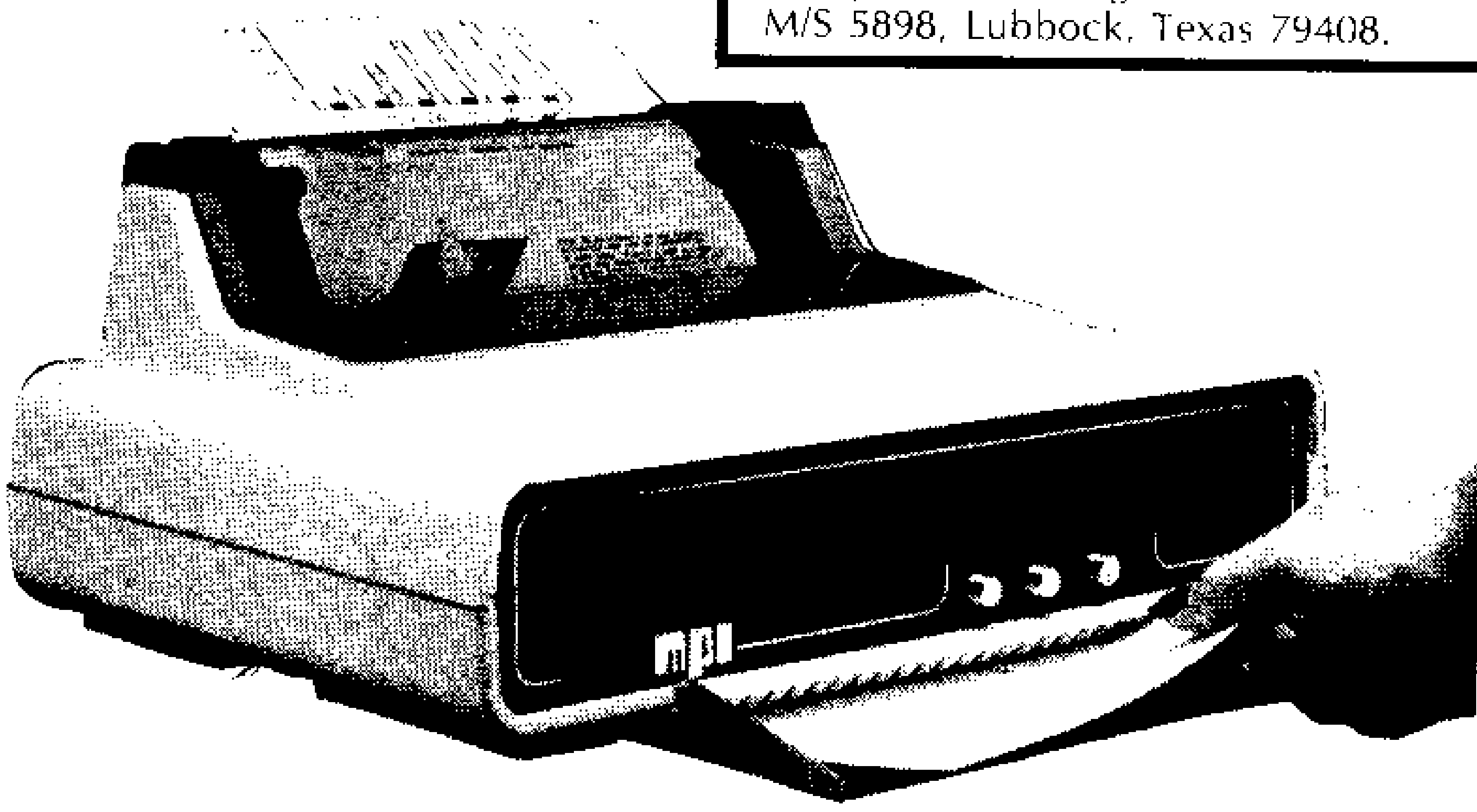

DEBUGS ON DISPLAY

99'er Program Bug

Pocket Battleship sinks . . .
For those of you who have been trying to understand the November 1982 **Professor Holl's Pocket Battleship** article (page 33), we must apologize for resequencing the listing without updating the text references. Here is a copy of the listing that is sequenced to match the text of the article. Either listing will RUN the same.

```
100 REM  POCKET BATTLESHIP
110 REM  99'ER VERSION 2.1.2
120 REM  BY S. T. HOLL
130 REM
140 REM
1000 CALL COLOR(11,16,1)
1010 CALL COLOR(12,15,15)
1020 CALL CHAR(119,"5A995A3C5A995A9
     9")
1030 CALL CLEAR
1040 RANDOMIZE
1050 NSHOTS=0
1060 TRANGE=25000+(RND-.5)*10000
1070 GOSUB 1270
1080 INPUT "INITIAL RANGE?":GRANGE
1085 PRINT :::
1090 IF ABS(GRANGE-TRANGE)<20 THEN
     1210
1100 GOSUB 1270
1110 NSHOTS=NSHOTS+1
1120 IF GRANGE<TRANGE THEN 1150
1130 CALL VCHAR(21,22,119,1)
1140 GOTO 1160
1150 CALL VCHAR(21,22,119,2)
1160 PRINT "SPOT?"
1170 INPUT SPOT
1180 GRANGE=GRANGE+SPOT
1190 PRINT "GUN RANGE=";GRANGE
1200 GOTO 1090
1210 GOSUB 1270
1220 PRINT "  SURFACE RAIDER SANK"
1230 PRINT "  AFTER ";NSHOTS;" SALV
     OS."
1240 INPUT DUMMY$
1250 GOTO 1000
1260 STOP
1270 CALL HCHAR(24,18,123,7)
1280 CALL HCHAR(23,20,123,1)
1290 PRINT ::
1300 RETURN
```

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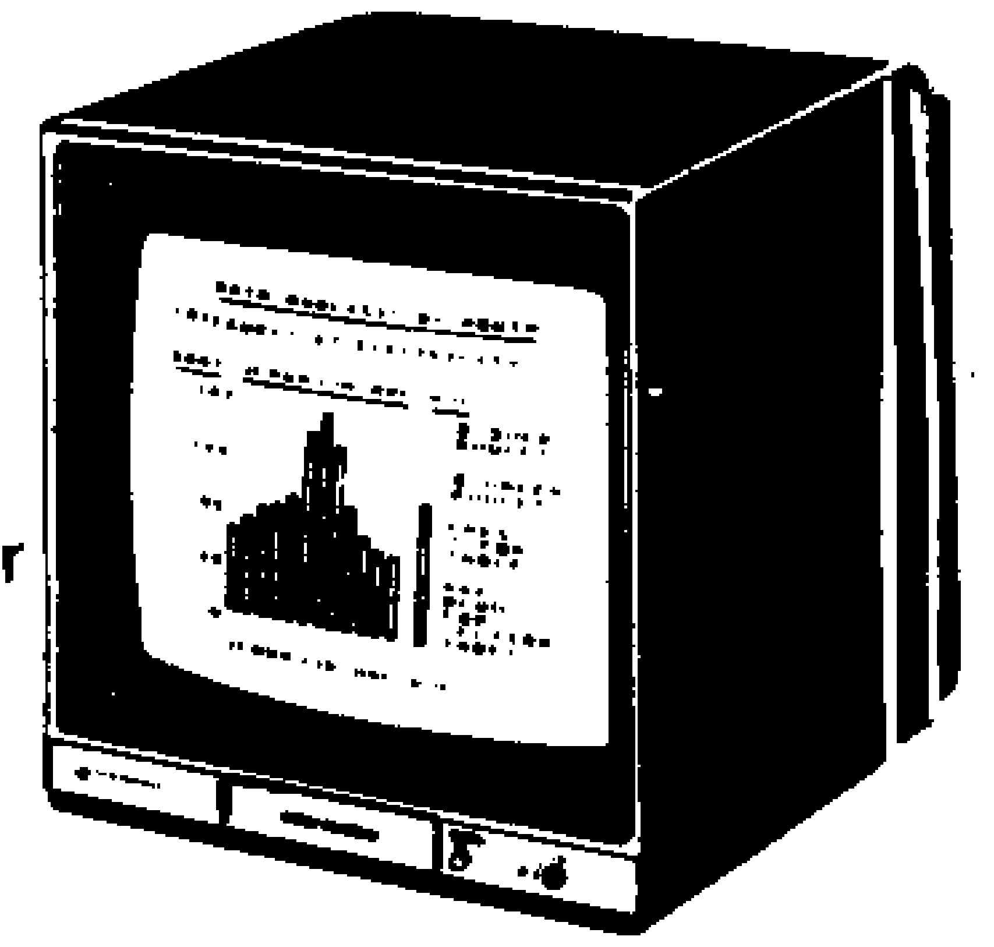

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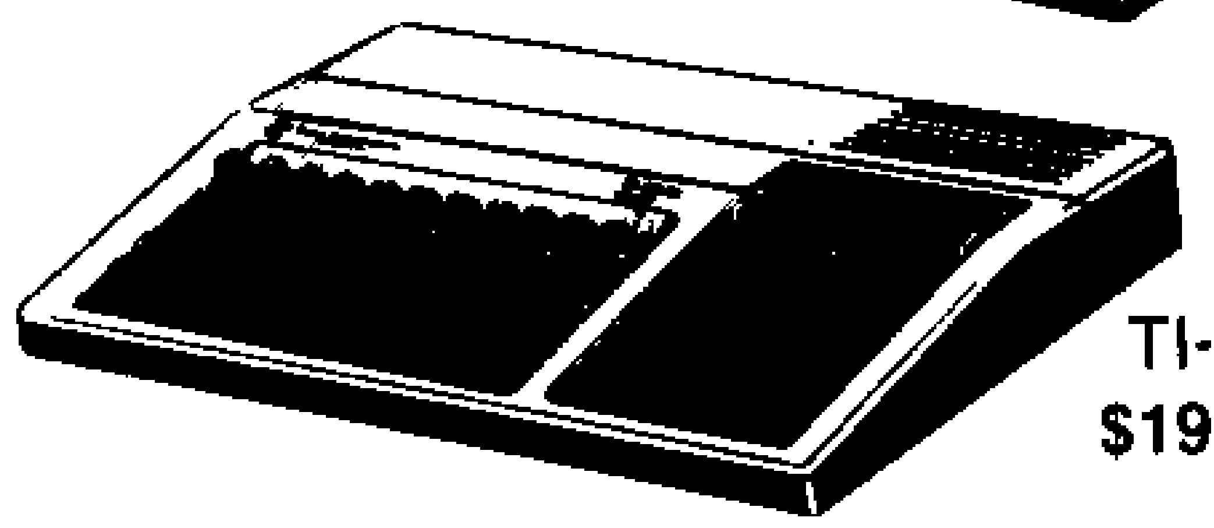

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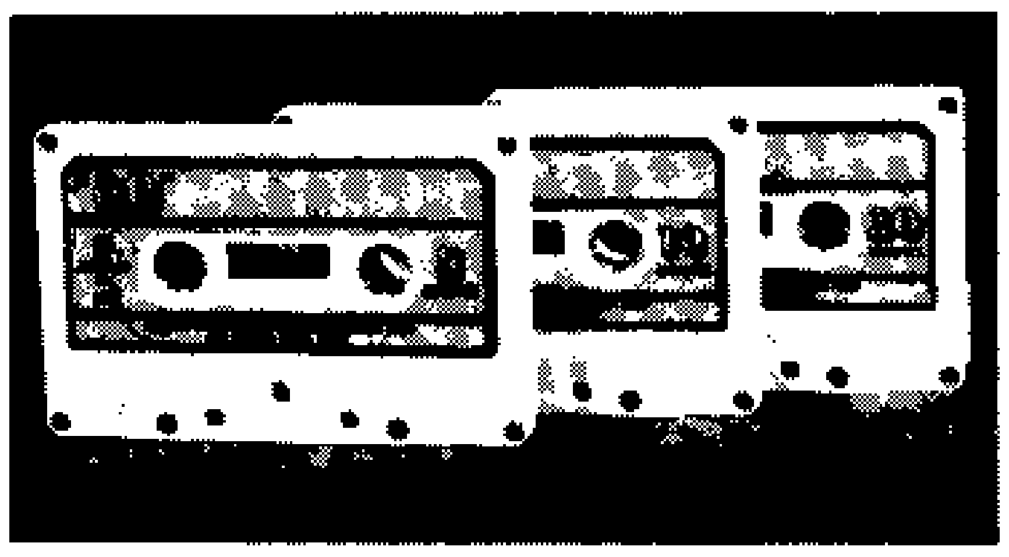

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Alphabet... from p.14

1160	The correct letter was selected.
1170	The wrong letter was selected.
1180-1210	Change direction of cursor and wait for a while so student can release the joystick before replacing the cursor.
1220-1320	Wrong letter selected so hit the shark with the hammer three times.
1330-1340	Remove shark and hammer and tell student he is wrong.
1350	If CNT is zero this is the first try on this letter so give student another chance.
1360-1460	Show student the correct letter after his second try.
1470	Start the shark again.
1480	Mark the letter as being wrong.
1490	Count the times this letter was wrong.
1500	If second time wrong reset the count and go pick another letter otherwise give him the same letter.
1510	Correct answer.
1520-1530	Mark letter as correct.
1540-1560	A little encouragement once in a while.
1570	Reset error count in case he was wrong once on this letter.
1580	Get the shark moving again.
1590	Replace the letter in the ocean with a wave.
1600	Go get the next letter.
1610-1620	Signal done.
1630-1660	Go through the correct array and show letters not correct after two tries.
1670	If all were correct.
1680	THE END.
1690-1700	Pick a random location for a letter in the ocean.
1710-1720	If there already is a letter or wave there go pick another location.
1730-1750	Put the letter in the ocean and its location co-ordinates the arrays.
1760-1770	Say the letter placed and return.
1780-1800	Move the shark randomly.
1810-1890	The mouth eats the letter in the ocean.

```
100 REM **************************
110 REM * LEARNING THE ALPHABET *
120 REM **************************
130 REM
140 REM BY RON BINKOWSKI
150 REM 99'ER VERSION 2.3.1XB
160 REM
170 REM
180 CALL CLEAR :: RANDOMIZE
190 CALL SCREEN(8):: CALL COLOR(11,
    6,1)
200 CALL CHAR(96,"001038387C7CFEFE"
    )
210 CALL CHAR(97,"01030101010141FF"
    )
220 CALL CHAR(98,"030703030141F1FF"
    )
230 CALL CHAR(99,"070F070343E3FFFF"
    )
240 CALL CHAR(100,"0E1F0F47E3F3FF7F
    ")
250 CALL CHAR(101,"1E3F5FEFF7FFFF7F
    ")
260 CALL CHAR(102,"3C7EFFFFFFFF7F3F
    ")
270 CALL CHAR(103,"81FFFFFF99181818
    ")
280 CALL CHAR(104,"2060F0381C2F4684
    ")
290 CALL CHAR(105,"1F0E0EFEFE0E0E1F
    ")
300 CALL CHAR(112,"000015AA40")
310 CALL CHAR(113,"0000000855A2")
320 CALL CHAR(114,"0020558A")
330 CALL CHAR(115,"04AA51")
340 DIM LY(26)
350 DIM LX(26)
360 DIM RIGHT(26)
370 DIM WRONG(26)
380 DIM USED(26)
390 FOR X=0 TO 25
400 RIGHT(X)=0 :: WRONG(O)=0
410 NEXT X
420 FOR X=0 TO 25 :: USED(X)=0 :: N
    EXT X
430 DIR=1 :: X=1
440 AA$="ANA1A1A1ANANA1ANANA1A1ANAN
    ANANA1A1ANANA1A1A1A1ANA1A1"
450 CALL HCHAR(1,1,42)
460 FOR A=1 TO 20
470 CALL HCHAR(INT(RND*20+3),INT(RN
    D*28+3),INT(RND*4+112))
480 NEXT A
490 FOR A=65 TO 73
500 CALL HCHAR(1,A-63,A)
510 GOSUB 1690
520 NEXT A
530 CALL HCHAR(1,11,42)
540 FOR A=74 TO 82
550 CALL HCHAR(1,A-62,A)
560 GOSUB 1690
570 NEXT A
580 CALL HCHAR(1,21,42)
590 FOR A=83 TO 90
600 CALL HCHAR(1,A-61,A)
610 GOSUB 1690
620 NEXT A
630 CALL HCHAR(1,30,42)
640 CALL HCHAR(1,31,63)
650 CALL HCHAR(1,32,33)
660 CALL SPRITE(#1,96,15,RND*170+10
    ,RND*235+10,RND*20-10,RND*20-10
    )
670 LTR=INT(RND*26)
680 IF U=26 THEN 1610
690 IF USED(LTR)=1 THEN 670
700 USED(LTR)=1
```

Continued on p. 66

ELIZA IS HERE!

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Simon Kind...from p.37

```
1920 CALL HCHAR(23,25,63)
1930 CALL HCHAR(23,26,158)
1940 CALL HCHAR(23,27,159)
1950 CALL HCHAR(23,28,63)
1960 DIM NOTE(50)
1970 RANDOMIZE
1980 R$="R"
1990 Y$="Y"
2000 G$="G"
2010 B$="B"
2020 W$="W"
2030 FOR X=1 TO 50
2040 NOTE(X)=INT(RND*5)+1
2050 NEXT X
2060 DIF=0
2070 CL=0
2080 P=0
2090 P=P+1
2100 AN$=""
2110 A$=""
2120 W=0
2130 FOR X=1 TO P
2140 IF NOTE(X)=1 THEN 2150 ELSE 22
     00
2150 FREQ=262
2160 Z=104
2170 C=13
2180 A$=A$&R$
2190 GOTO 2420
2200 IF NOTE(X)=2 THEN 2210 ELSE 22
     60
2210 FREQ=294
2220 Z=112
2230 C=15
2240 A$=A$&Y$
2250 GOTO 2420
2260 IF NOTE(X)=3 THEN 2270 ELSE 23
     20
2270 FREQ=330
2280 Z=120
2290 C=17
2300 A$=A$&G$
2310 GOTO 2420
2320 IF NOTE(X)=4 THEN 2330 ELSE 23
     80
2330 FREQ=349
2340 Z=128
2350 C=19
2360 A$=A$&B$
2370 GOTO 2420
2380 FREQ=392
2390 Z=136
2400 C=21
2410 A$=A$&W$
2420 IF DIF=1 THEN 2430 ELSE 2450
2430 CALL SOUND(80,FREQ,1,FREQ*1.01
     ,1)
2440 GOTO 2480
2450 CALL SOUND(600-11*P,FREQ,1,FRE
     Q*1.01,1)
2460 IF CL=1 THEN 2470 ELSE 2480
2470 Z=87
2480 CALL VCHAR(10,C,Z,2)
2490 IF DIF=1 THEN 2520
2500 FOR D=1 TO (160-3*P)
2510 NEXT D
2520 CALL VCHAR(10,C,87,2)
2530 NEXT X
2540 IF X=51 THEN 1550
2550 REM TO ELIMINATE KEY
2560 REM LOCK OUT CHANGE
2570 REM S<1 TO S=0 IN 2590
2580 CALL KEY(0,K,S)
2590 CALL HCHAR(17,17,32)
2600 CALL HCHAR(17,17,88)
2610 IF S<1 THEN 2580
2620 IF K<58 THEN 3120
2630 IF K=66 THEN 2700
2640 IF K=71 THEN 2700
2650 IF K=82 THEN 2700
2660 IF K=87 THEN 2700
2670 IF K=89 THEN 2700
2680 CALL SOUND(300,-2,2)
2690 GOTO 2580
2700 AN$=AN$&CHR$(K)
2710 IF DIF=1 THEN 2720 ELSE 2740
2720 U=60
2730 GOTO 2750
2740 U=300
2750 IF K=82 THEN 2760 ELSE 2800
2760 CALL HCHAR(23,13,104)
2770 CALL SOUND(U,262,3)
2780 GOSUB 3100
2790 GOTO 2990
2800 IF K=89 THEN 2810 ELSE 2850
2810 CALL HCHAR(23,15,112)
2820 CALL SOUND(U,294,3)
2830 GOSUB 3100
2840 GOTO 2990
2850 IF K=71 THEN 2860 ELSE 2900
2860 CALL HCHAR(23,17,120)
2870 CALL SOUND(U,330,3)
2880 GOSUB 3100
2890 GOTO 2990
2900 IF K=66 THEN 2910 ELSE 2950
2910 CALL HCHAR(23,19,128)
2920 CALL SOUND(U,349,3)
2930 GOSUB 3100
2940 GOTO 2990
2950 IF K=87 THEN 2960 ELSE 3040
2960 CALL HCHAR(23,21,136)
2970 CALL SOUND(U,392,3)
2980 GOSUB 3100
2990 W=W+1
3000 IF W=P THEN 3010 ELSE 2580
3010 IF A$=AN$ THEN 3020 ELSE 3040
3020 GOSUB 3310
3030 GOTO 2090
3040 CALL SOUND(1500,110,2)
3050 CALL SOUND(1000,-4,3)
3060 FOR X=1 TO 500
3070 NEXT X
```

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```
3080 CALL HCHAR(23,8,58,2)
3090 GOTO 1810
3100 CALL HCHAR(23,13,40,9)
3110 RETURN
3120 IF K=49 THEN 3130 ELSE 3150
3130 A$=""
3140 GOTO 2130
3150 IF K=48 THEN 3280
3160 IF K=52 THEN 3170 ELSE 3180
3170 DIF=1
3180 IF K=50 THEN 3190 ELSE 3220
3190 W=0
3200 AN$=""
3210 GOTO 2580
3220 IF K=51 THEN 3230 ELSE 3250
3230 P=50
3240 GOTO 2130
3250 IF K=53 THEN 3260 ELSE 2680
3260 CL=1
3270 GOTO 2580
3280 CALL CLEAR
3290 PRINT
3300 END
3310 POINT$=STR$(P)
3320 FOR I=1 TO LEN(POINT$)
3330 CODE=ASC(SEG$(POINT$,I,1))
3340 CALL HCHAR(23,7+I,CODE)
3350 NEXT I
3360 IF P>HIGH THEN 3370 ELSE 3500
3370 HIG$=STR$(P)
3380 FOR I=1 TO LEN(HIG$)
3390 CODE=ASC(SEG$(HIG$,I,1))
3400 CALL HCHAR(23.30+I,CODE)
3410 NEXT I
3420 HIGH=P
3430 IF P=20 THEN 3440 ELSE 3490
3440 CALL SCREEN(16)
3450 FOR DY=1 TO 50
3460 NEXT DY
3470 CALL SCREEN(2)
3480 GOSUB 3530
3490 IF P=15 THEN 4010 ELSE 3500
3500 IF P=10 THEN 3510 ELSE 3520
3510 GOSUB 3530
3520 RETURN
3530 FOR X=1 TO 50
3540 CALL COLOR((INT(RND*3+6)),(INT
     (RND*14+3)),1)
3550 NEXT X
3560 CALL COLOR(6,8,1)
3570 CALL COLOR(7,8,1)
3580 CALL COLOR(8,5,1)
3590 CALL GCHAR(21,21,OC)
3600 IF OC=32 THEN 3730
3610 FOR X=18 TO 21
3620 CALL HCHAR(X,X,105)
3630 CALL SOUND(-100,2000,7)
3640 NEXT X
3650 CALL HCHAR(21,21,138)
3660 CALL SOUND(-100,-5,0)
3670 CALL SOUND(200,-5,5)
3680 FOR DY=1 TO 10
3690 NEXT DY
3700 FOR X=18 TO 21
3710 CALL HCHAR(X,X,32)
3720 NEXT X
3730 CALL VCHAR(13,21,136,9)
3740 FOR DY=1 TO 200
3750 NEXT DY
3760 CALL HCHAR(20,21,139)
3770 CALL HCHAR(21,21,141)
3780 CALL VCHAR(13,21,32,7)
3790 FOR DY=1 TO 1000
3800 NEXT DY
3810 CALL HCHAR(20,21,138)
3820 CALL HCHAR(21,21,140)
3830 FOR DY=1 TO 1000
3840 NEXT DY
3850 DATA 400,523,1,21,136,300,587,
     1,13,104,400,466,1,17,120,500,
     233,1,15,112,1000,349,2,19,128
3860 FOR X=1 TO 5
3870 READ F1,F2,F3,F4,F5
3880 CALL SOUND(F1,F2,F3)
3890 CALL VCHAR(10,F4,F5)
3900 NEXT X
3910 RESTORE 3850
3920 CALL HCHAR(10,12,87,10)
3930 GOSUB 4010
3940 GOSUB 4260
3950 CALL VCHAR(13,21,136,9)
3960 FOR DY=1 TO 200
3970 NEXT DY
3980 CALL VCHAR(13,21,32,9)
3990 CALL HCHAR(21,21,OC)
4000 RETURN
4010 FOR X=1 TO 50
4020 DIS=INT(RND*5+1)
4030 ON DIS GOSUB 4060,4100,4140,41
     80,4220
4040 NEXT X
4050 RETURN
4060 CALL VCHAR(10,21,136,2)
4070 CALL SOUND(-1,523,9)
4080 CALL VCHAR(10,21,87,2)
4090 RETURN
4100 CALL VCHAR(10,13,104,2)
4110 CALL SOUND(-1,587,9)
4120 CALL VCHAR(10,13,87,2)
4130 RETURN
4140 CALL VCHAR(10,17,120,2)
4150 CALL SOUND(-1,466,9)
4160 CALL VCHAR(10,17,87,2)
4170 RETURN
4180 CALL VCHAR(10,15,112,2)
4190 CALL SOUND(-1,233,9)
4200 CALL VCHAR(10,15,87,2)
4210 RETURN
4220 CALL VCHAR(10,19,128,2)
4230 CALL SOUND(-1,349,9)
4240 CALL VCHAR(10,19,87,2)
4250 RETURN
4260 CALL HCHAR(10,12,87,10)
4270 CALL HCHAR(11,12,87,10)
4280 RETURN
```

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Alphabet...from p.61

```
710 U=U+1
720 LTR$=CHR$(LTR+65)
730 A$=SEG$(AA$,LTR*2+1,2)
740 CALL SAY("FIND",,"",,A$,,"",,LT
    R$)
750 CALL GCHAR(1,X,GOT)
760 CT=CT+1
770 IF CT<>15 THEN 800
780 CALL MOTION(#1,RND*20-10,RND*20
    -10)
790 CT=0
800 CALL HCHAR(1,X,30)
810 FOR TD=1 TO 30 :: NEXT TD
820 CALL HCHAR(1,X,GOT)
830 CALL JOYST(1,K,J)
840 HP=HP+1 :: IF J<>PJ THEN HP=0 :
    : PJ=J :: GOTO 930
850 IF HP<50 THEN 930
860 CALL SAY("R U O K")
870 CALL SAY("MOVE THE JOYSTICK")
880 CALL SOUND(-1000,-7,0)
890 CALL JOYST(1,K,J)
900 IF J=PJ THEN 860
910 HP=0
920 GOTO 760
930 IF J=0 THEN 760
940 IF J=-4 THEN CALL SOUND(-10,200
    0,0):: GOTO 990
950 X=X+DIR
960 IF X<1 THEN X=32 :: GOTO 750
970 IF X>32 THEN X=1
980 GOTO 750
990 IF GOT=63 THEN CALL SAY("I SAID
    "):: GOTO 740
1000 IF GOT=42 THEN 1190
1010 IF GOT=33 THEN CALL SAY("I NEE
     D HELP PLEASE"):: GOTO 740
1020 ON ERROR 1140
1030 ON WARNING NEXT
1040 TOY=(LY(GOT-64)-1)*8+1
1050 TOX=LX(GOT-64)*8+1
1060 CALL MOTION(#1,0,0)
1070 CALL POSITION(#1,Y,Z)
1080 DY=TOY-Y
1090 DX=TOX-Z
1100 TOT=(ABS(DY)+ABS(DX))/10
1110 CALL MOTION(#1,DY/TOT,DX/TOT)
1120 CALL COINC(#1,TOY,TOX,8,HIT)
1130 IF HIT=0 THEN 1070
1140 CALL MOTION(#1,0,0)
1150 CALL LOCATE(#1,TOY,TOX)
1160 IF GOT-65=LTR THEN 1810
1170 GOTO 1240
1180 IF GOT<>42 THEN 1220
1190 DIR=DIR*-1
1200 FOR D=1 TO 200 :: NEXT D
1210 GOTO 950
1220 IF GOT=63 THEN CALL SAY("I SAI
     D"):: GOTO 740
1230 IF GOT=33 THEN CALL SAY("I NEE
     D HELP PLEASE"):: CALL SOUND(-
     1000,-7,0):: GOTO 740
1240 FOR HITS=1 TO 3
1250 CALL SPRITE(#2,103,11,TOY-8,TO
     X-8,0,0)
1260 FOR DY=1 TO 25 :: NEXT DY
1270 CALL SPRITE(#2,104,11,TOY-8,TO
     X,0,0)
1280 FOR DY=1 TO 25 :: NEXT DY
1290 CALL SPRITE(#2,105,11,TOY-4,TO
     X,0,0)
1300 CALL SOUND(100,330,0,-4,0)
1310 CALL SAY("UHOH")
1320 NEXT HITS
1330 CALL DELSPRITE(#2,#1)
1340 CALL SAY("THAT IS NOT ",,A$,,"
     ",,LTR$)
1350 IF CNT=0 THEN 1470
1360 CALL SAY("THIS IS ",,A$,,"",,L
     TR$)
1370 CALL HCHAR(LY(LTR+1),LX(LTR+1)
     ,32)
1380 CALL SPRITE(#2,LTR+65,2,(LY(LT
     R+1)-1)*8+1,(LX(LTR+1)-1)*8+1,
     0,0)
1390 FOR HITS=1 TO 5
1400 CALL MAGNIFY(2)
1410 FOR DY=1 TO 25 :: NEXT DY
1420 CALL MAGNIFY(1)
1430 FOR DY=1 TO 25 :: NEXT DY
1440 NEXT HITS
1450 CALL DELSPRITE(#2)
1460 CALL HCHAR(LY(LTR+1),LX(LTR+1)
     ,LTR+65)
1470 CALL SPRITE(#1,96,15,RND*150+5
     ,RND*200+5,RND*10-5,RND*10-5)
1480 WRONG(LTR)=WRONG(LTR)+1
1490 CNT=CNT+1
1500 IF CNT=2 THEN CNT=0 :: GOTO 67
     0 ELSE GOTO 740
1510 CALL SAY("THAT IS RIGHT")
1520 RIGHT(LTR)=RIGHT(LTR)+1
1530 RT=RT+1
1540 IF RT=10 THEN CALL SAY("YOU AR
     E DOING FINE")
1550 IF RT=20 THEN CALL SAY("GOOD W
     ORK")
1560 IF RT=26 THEN CALL SAY("ALL CO
     RRECT"):: CALL SAY("VERY VERY
     GOOD")
1570 CNT=0
1580 CALL MOTION(#1,RND*10-5,RND*10
     -5)
1590 CALL HCHAR(LY(GOT-64),LX(GOT-6
     4),INT(RND*4+112))
1600 GOTO 670
1610 CALL SAY("I AM DONE")
1620 CALL SOUND(-1000,-7,0)
1630 FOR X=0 TO 25
1640 IF RIGHT(X)>0 THEN 1660
1650 PRINT CHR$(X+65)
1660 NEXT X
1670 IF RT=26 THEN PRINT "ALL CORRE
     CT"
1680 STOP
1690 Y=INT(RND*20+3)
1700 X=INT(RND*25+3)
1710 CALL GCHAR(Y,X,GOT)
1720 IF GOT<>32 THEN 1690
1730 CALL HCHAR(Y,X,A)
1740 LY(A-64)=Y
1750 LX(A-64)=X
1760 CALL SAY(CHR$(A))
1770 RETURN
1780 CALL MOTION(#1,RND*10-5,RND*10
     -5)
1790 CT=0
1800 GOTO 800
1810 CALL SPRITE(#2,97,15,TOY,TOX-8
     ,0,0)
1820 FOR P=97 TO 102
1830 CALL SOUND(-1000,(103-P)*110+1
     10,0,-5,10)
1840 CALL PATTERN(#2,P)
1850 FOR D=1 TO 65 :: NEXT D
1860 NEXT P
1870 CALL HCHAR(LY(GOT-64),LX(GOT-6
     4),32)
1880 CALL DELSPRITE(#2)
1890 GOTO 1510
```

Engineering...from p.56

```
5340 REM    SUBU16 - COMMON TITLE
5350 PRINT "   ELECTRICAL ENGINEERI
     NG"
5360 PRINT :TAB(8);"FUNDAMENTALS"
5370 PRINT ::"** RESISTANCE COMBINA
     TION **"
5380 RETURN
5390 REM
5400 REM  SUBU17 - DRAW SERIES CIRC
     UIT - ANNOTATED
5410 CALL CLEAR
5420 GOSUB 4600
5430 CALL HCHAR(21,9,82)
5440 CALL HCHAR(21,10,84)
5450 CALL HCHAR(22,9,112)
5460 CALL HCHAR(22,10,113)
5470 CALL HCHAR(18,15,82)
5480 CALL HCHAR(18,16,49)
5490 CALL HCHAR(21,21,82)
5500 CALL HCHAR(21,22,50)
5510 CALL HCHAR(23,15,82)
5520 CALL HCHAR(23,16,51)
5530 RETURN
5540 REM
5550 REM  SUBU18 - DRAW PARALLEL CI
     RCUIT - ANNOTATED
5560 CALL CLEAR
5570 GOSUB 4780
5580 CALL HCHAR(21,8,82)
5590 CALL HCHAR(21,9,84)
5600 CALL HCHAR(22,8,112)
5610 CALL HCHAR(22,9,113)
5620 CALL HCHAR(21,13,82)
5630 CALL HCHAR(21,14,49)
5640 CALL HCHAR(21,17,82)
5650 CALL HCHAR(21,18,50)
5660 CALL HCHAR(21,21,82)
5670 CALL HCHAR(21,22,51)
5680 RETURN
5690 REM
5700 REM  SUBU19 - DRAW DELTA-Y CIR
     CUITS - ANNOTATED
5710 CALL CLEAR
5720 YO=4
5730 GOSUB 4990
5740 CALL HCHAR(19,3,120)
5750 CALL HCHAR(24,3,121)
5760 CALL HCHAR(24,15,122)
5770 CALL HCHAR(21,7,82)
5780 CALL HCHAR(21,8,51)
5790 CALL HCHAR(21,14,82)
5800 CALL HCHAR(21,15,50)
5810 CALL HCHAR(23,9,82)
5820 CALL HCHAR(23,10,49)
5830 YO=19
5840 GOSUB 5190
5850 CALL HCHAR(18,24,120)
5860 CALL HCHAR(24,18,121)
5870 CALL HCHAR(24,30,122)
5880 CALL HCHAR(21,25,82)
5890 CALL HCHAR(21,26,65)
5900 CALL HCHAR(23,21,82)
5910 CALL HCHAR(23,22,66)
5920 CALL HCHAR(23,26,82)
5930 CALL HCHAR(23,27,67)
5940 PRINT ::"    ""DELTA""";TAB(21)
     ;"""Y"""
5950 RETURN
5960 REM
5970 REM  SUSU20 - COMMON STATEMENT
     S
5980 PRINT ::"IN SUCH CASES, CONVER
     TING"
5990 PRINT "FROM A ""DELTA"" TO AN
     EQUIVA-"
6000 PRINT "LENT ""Y"", OR VICE VER
     SA, MAY"
6010 PRINT "ENABLE FURTHER REDUCTIO
     N"
6020 PRINT "IN THE NETWORK."
6030 PRINT :"TO ACHIEVE DELTA-Y EQU
     IVA-"
6040 PRINT "LENCE, THE RESISTANCE V
     IEWED"
6050 PRINT "FROM ANY TWO OF THE THR
     EE"
6060 PRINT "TERMINALS MUST BE THE S
     AME"
6070 PRINT "IN BOTH CONFIGURATIONS.
     "::
6080 RETURN
6090 REM
6100 REM  SUBU21 - COMMON STATEMENTS
6110 PRINT ::"A ""DELTA"" AND A ""Y
     "" ARE"
6120 PRINT "EQUIVALENT IF AND ONLY
     IF:"
6130 PRINT :TAB(7);"DELTA";TAB(19);
     "Y"
6140 PRINT TAB(7);"-----";TAB(17);"
     -----"
6150 PRINT TAB(7);"R(";A$;B$;")   =
      R(";A$;B$;")"
6160 PRINT TAB(7);"R(";A$;C$;")   =
      R(";A$;C$;")"
6170 PRINT TAB(7);"R(";B$;C$;")   =
      R(";B$;C$;")":::
6180 RETURN
6190 REM
6200 REM  SUBU22 - PRINT DELTA-Y ST
     ATEMENTS
6210 XO=19
6220 GOSUB 5720
6230 GOSUB 4120
6240 GOSUB 3610
6250 GOSUB 5710
6260 GOSUB 5980
6270 GOSUB 3610
6280 GOSUB 5710
6290 GOSUB 6110
6300 GOSUB 3610
6310 GOSUB 5710
6320 RETURN
```

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Adventuring...from p.29

you, because only the right decisions at the right time will keep you from being "killed off."

These adventures take place with beautiful color graphic scenes, or they can be limited to textual descriptions printed on your monitor. The *Tunnels of Doom* Command Cartridge from TI is a good example of a Sword and Sorcery adventure. This game (in both text and graphic form) has attracted a large following who love the game's derring-do graphics. With a little imagination, players can undertake a dangerous mission calling for wits, skill, and physical prowess. Where else but on your trusty TI computer can you find anything to compare with the kind of adventure and excitement of *The Raiders of the Lost Ark?* And all within the comfort and safety of your own home!

The Puzzle of Adventuring

The second form of adventure is more puzzle-oriented. The object of these adventures is to find hidden treasures and return them to a particular location. However, adventure games aren't limited to treasure hunts. They may require you to escape a burning building or a deserted space station; or save a princess; or find and defuse a bomb. The game is over when you achieve your objective. Unlike the Sword and Sorcery kind of adventure, you usually won't know in advance what the treasure (if any) will be.

In some of these adventures, there may be a monster or two, but rather than fighting them with sword or magic, you are expected to do away with them by using your wits. The key to these adventures is to logically solve a series of puzzles. Please don't assume that you simply answer puzzle questions in order to advance to the next location. It is never as boring as that. You may not even know when you are given a puzzle to solve!

Let me demonstrate by briefly describing a game I played recently. In this adventure you awaken inside a house. No matter what you try to do in this house, you keep touching things that electrocute you. You are stymied: There is no way out! How did I survive when I played this adventure? At first, it wasn't easy! But by paying attention to the clock on the dining room wall (which said 10:00 PM), noticing the stack of mail on the kitchen table and reading a letter marked IMPORTANT, I found out that the electricity was being shut off at midnight for non-payment. I realized then, that surviving meant telling the game to "WAIT." When midnight came, I was free to continue on my adventure.

Notice that solving this puzzle had nothing to do with magic or fighting. It was solved by exploring the surroundings and working out a logical solution—relying on powers of observation and common sense. By the way, before WAITing, I had to find a flashlight, because the lights went out at midnight!

The Adventure of Communicating

In the adventure above, I had to tell the game to WAIT until midnight. How did I know that the game would understand me? I didn't. In fact, I never know what the game will understand as a command until I try it out. In all adventures, half the problem (and half the fun!) is trying to get the game to do what you want. Sometimes you have to re-phrase a command or word to make the game understand. Even if the game does understand, sometimes it won't respond until you first do something else. In one adventure by Scott Adams, I kept trying to pull down a ladder suspended from the ceiling. No matter what I tried, I couldn't reach the ladder or get it down. I gave up and continued my adventure. Later, after I had completed certain tasks, the ladder came down by itself!

Why do people become addicted to these adventures? For the same reason that they do other types of puzzles—for the challenge of showing that they have the wits to find a solution.

Next time, we examine some basic rules to follow when adventuring. Until then, keep your sword sharp and powder dry. . .

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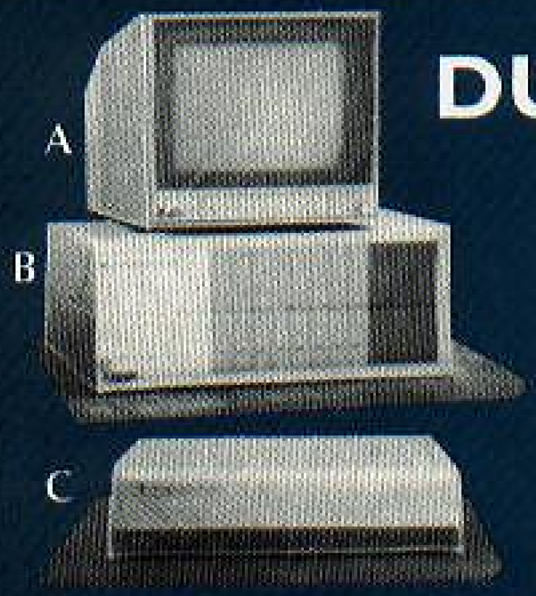

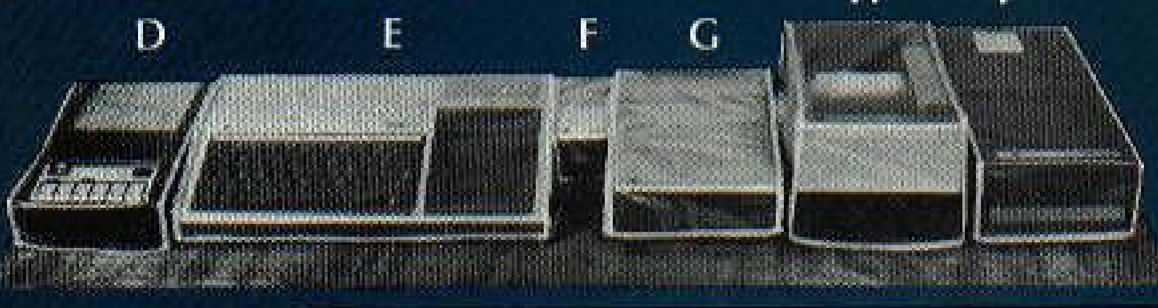

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